IFP

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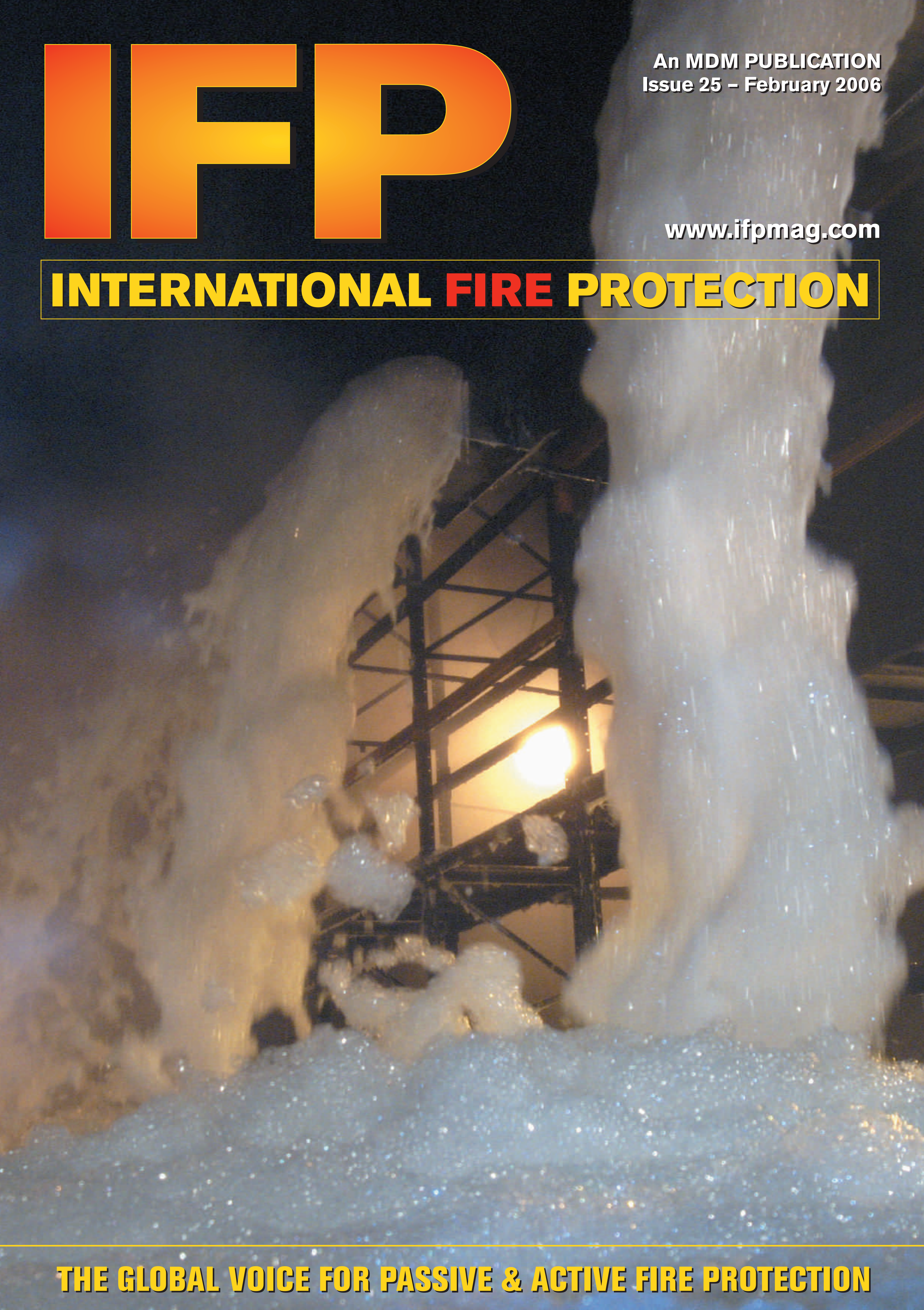
INTERNATIONAL FIRE PROTECTION



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February 2006
Issue 25

Front Cover Picture: Hot Foam System, picture from Tyco Fire & Safety

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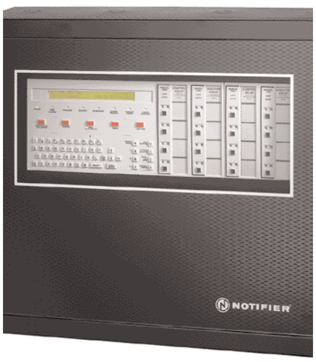

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Cranford Controls introduces new call point range

Well known for its comprehensive range of sounders and beacons for the fire, security and process control industries, CRANFORD CONTROLS has extended its product portfolio with the introduction of a range of manual call points. The units are very competitively priced; they are easy to install, saving on-site time and their innovative design makes commissioning, testing, servicing and resetting after use a simple process.

The call point is available with either a break glass or resetable operating element, which are freely interchangeable into the standard body, allowing the unit to be optimised to the application. All devices are fitted with a 470 Ohm resistor as standard, making them compatible with the great majority of conventional fire control panels on the market. An optional local LED indicator can be fitted to both versions if required.

A single key is used to open the top-hinged front cover to replace the break glass element and also to restore the resetable version after operation. For surface mounting, a back box, which will accept one or two standard 20mm cable entries, is provided. If the device is to be flush mounted, it mounts directly onto a standard 25mm deep UK electrical back box. Manufactured to EN54 Part 11 Specification

Cranford Controls are committed to quality and customer service and have launched the call points to enhance our product range. We also hope that this introduction will increase our effectiveness to be able to offer our customers a one-stop fire alarm accessories shop.

If you would like more information or would like to see a sample please contact our sales team on +44 (0) 1420 592 444 or go to www.cranfordcontrols.com

Viking Offers Highest Performing Residential Sidewall Sprinklers

The VIKING CORPORATION, a global leader in fixed fire protection products, announces expanded listings for the Microtech™ 4.0 (5,8) K factor residential sidewall sprinkler. With the launch of its VK453 product, Viking has extended its innovative, patent-pending Microtech™ technology to larger room sizes. As a result, Viking now offers residential sidewall sprinklers with the lowest flows at any listed room size, including the industry's only listings for 18 x 20 ft (5,5 x 6,1 m) rooms.

The new, cULus listings for the VK453 sprinkler include the industry's lowest flows for 16 x 18 ft (4,9 x 5,5 m), 18 x 18 ft (5,5 x 5,5 m), and 18 x 20 ft (5,5 x 6,1 m) rooms. This technology builds upon the VK452 Microtech™ residential sidewall, launched earlier this year, which offers the lowest flows for 12 x 12 ft (3,7 x 3,7 m), 14 x 14 ft (4,3 x 4,3 m), and 16 x 16 ft (4,9 x 4,9 m) room sizes.

For over 80 years, Viking has been a worldwide leader in the manufacture and distribution of innovative fire protection equipment. Their products are sold in over 70 countries through an integrated distribution network. For more information any of Viking's quality products, please visit www.vikingcorp.com or call 877-384-5464.

Contact: Karla Suwyn
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ksuwyn@vikingcorp.com

New Atex Certified High Temperature Flammable Gas Detector

The new, ATEX certified Xgard Type 4 gas detector from Crowcon is designed to quickly detect flammable gases in high temperature applications (up to 150oC) such as gas turbines or gas-fired drying ovens. Gas turbines are usually operated with natural gas (or sometimes naphtha) at high flow volumes, so a gas leak could be extremely dangerous.

According to the UK HSE*, at least one gas detector should always be installed if a gas turbine has a continuous gas supply. This detector should be located in the ventilation outlet, as a leak will always reach it. Additional detectors can also be installed at other points around the turbine to increase the probability of detecting small leaks. The main detector in the ventilation outlet should be set to alarm at the lowest practical level – preferably below 5% of the lower explosion limit (LEL) but no higher than 10%.

Because of the extremely high temperatures generated by gas turbines, conventional sensors cannot be used. The Xgard Type 4 is therefore ideal for this application. Suitable for Zone 1 and Zone 2 hazardous areas, the detector's sensor contains poison-resistant catalytic beads which can detect hydrocarbons at high temperatures.

With a life of up to five years, the Xgard Type 4's sensor has a 316 stainless steel housing, with the choice of a marine grade aluminium or 316 stainless steel junction box for ultimate corrosion resistance in extreme environments. The aluminium junction box is protected by a tough polyester coating. Both types of junction box have lugs for both wall and ceiling mounting, removing the need for additional brackets, while a choice of four cable gland sizes allows quick and easy installation on any site.

For more information, please visit Crowcon's website at www.crowcon.com

Kingfell demonstrates expertise in the retail sector

KINGFELL PLC, one of the UK's premier fire safety and protection specialists, has continued to expand its portfolio with the winning of a number of ongoing contracts in the retail sector. The company, which has two operating divisions – Kingfell Fire Engineering and KFP Consulting – has long since proved itself a leader in the transport industry, with maintenance contracts at 11 major London train stations. However, this responsibility also extends to embrace the retail units located in these stations where Kingfell's role is to design, install and commission the fire detection and alarm systems.

The Body Shop, Vodafone, Starbucks and Boots are just a few of the companies that have outlets available to the 385 million commuters that every year use Cannon Street, Charing Cross, Euston, Fenchurch Street, Gatwick, King's Cross, Liverpool Street, London Bridge, Paddington, Victoria and Waterloo train stations.

Paul Bryant, CEO of Kingfell Plc commented: "Even though retail units in stations follow a base specification, it is up to us to ensure that the fire detection and warning systems are specifically appropriate for the retail unit in question. These can be anything from small outlets like Millie's Cookies to large high street shops such as Marks and Spencer's Simply Food. We have to ensure that detectors will pick up fire at an early stage, while minimising the occurrence of false alarms."

Full details on Kingfell Plc and its two operating divisions, KFP Consulting and Kingfell Fire Engineering, can be found on the company's website at www.kingfell.co.uk. Alternatively, the company can be contacted by telephone on +44 (0) 20 7928 9995, by fax on +44 (0) 20 7928 5554, or via email at enquiries@kingfell.co.uk

New Chairman for BFPSA Marketing Group

Andrew Shiner has been appointed Chairman of the British Fire Protection Systems Association (BFPSA) marketing committee. Director of Marketing for Europe, Middle East & Africa, Fire Suppression SBU, Tyco Safety Products since March, 2004, Andrew has extensive experience of the fire industry. He has an MBA and a Postgraduate Diploma in Marketing.

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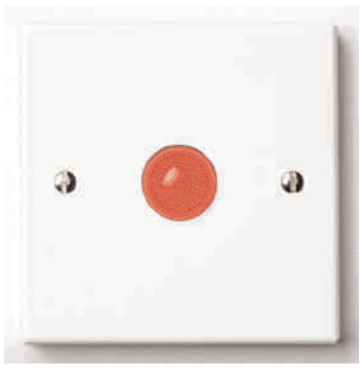
Spel expands product range with launch of new disabled alarm



A new range of alarms for disabled toilets has been launched by SPEL.

All the units have been designed to meet stringent BSI standards and are manufactured at the company's factory in Aldridge, West Midlands.

The units, made from sheet steel and available in three colours, can be supplied as packs or component parts to fit in with bespoke systems.

Systems can operate in the event of a power failure by adding a rechargeable nine-volt battery.

"This range is an important addition to the SPEL product list designed to comply with legislation from the Disability and Discrimination Act," said SPEL Managing Director Phil Elwell.

"It has been designed with high performance, ease of use and good aesthetics in mind and we are confident it will become a market leader."

Economy kits include a controller, pull-cord, and self adhesive label while standard kits also have a door beacon/sounder and a remote reset point.

SPEL is a division of ORBIK ELECTRONICS established in 1982 as a supplier of electronics for the emergency safety lighting market. It is now a recognised world leader in BSi-approved emergency lighting control gear, emergency and mains luminaires, central systems, intelligent systems and fire detection equipment.

You can find out more about Orbik at www.orbik.co.uk or SPEL at www.spelonline.co.uk

Calling all fire engineers and installers!

FIREX SOUTH
21-22 March 2006
Sandown Exhibition Centre

Firex South, the dedicated regional fire prevention and protection event, returns for a 3rd time at Sandown Park, from 21st–22nd March 2006

The show offers visitors the chance to enhance their knowledge via the comprehensive programme of free seminars. Running across both days, expert speakers from some of the UK's leading industry manufacturers and professional bodies will give practical advice, direct access to the latest market developments and the opportunity to learn from real case-study examples. This year's highlights include presentations from the NSI, B.A.F.E. and LPCB.

Showcasing the latest equipment from around 60 of the industry's leading specialists, Firex South will offer a convenient way to investigate the latest technology and the surrounding issues for those in the southern region.

Launched to complement the world-renowned International Fire Expo, the roadshow (which accompanies its sister show, Firex North at Harrogate International Centre from 17th-18th October 2006) is a great opportunity for those with a busy schedule who do not want to travel a great distance or stay overnight, preferring to make all their purchasing decisions in one day.

Additionally, with the new reform of fire safety legislation expected to come into force later this year, attendance to the show is expected to reach its highest yet. The Regulatory Reform (Fire Safety) Order is the biggest single reform of fire safety legislation in over 30 years and Firex South will provide an accessible source of information in this key area. The new regime will be subject to monitoring and enforcement action, and a weighty fine or, in extreme cases, imprisonment, can be levied against offenders. Firex South will offer a comprehensive programme of seminars developed to reflect this, with presentations from the LPCB, BAFE, St John Ambulance, Wagner UK and The Fire Beam Company.

The LPCB has a wide-ranging agenda for its seminar sessions, covering everything from training and publications to new loss prevention standards and extension of installer codes. In particular, it will be covering a new approval scheme that will assess the assessors, which was launched in December last year.

BAFE, exhibiting on Stand C20, will be focusing its seminar on the importance of third party certification and the role that the various schemes adopted by BAFE can play in that process.

"There was a terrific response to the last Firex South, proving that the simple formula works in answering the needs of the industry in the South East. Keeping this in mind we are returning in March 2006 with an even stronger show than before. We recognise that by providing our visitors with a successful show, they will return year after year," commented event manager Gerry Dunphy.

Co-located with Firex South for the first time will be the Security Roadshow taking place on 21st March, also at Sandown Park, where visitors will be able to explore cutting-edge security products. Like Firex South, the roadshow will give attendees the opportunity to find out about the latest industry developments, experience new products first-hand and discuss security solutions with the best security providers, all within a couple of hours. Register free online at www.security-installer.co.uk.

Firex South is aimed at installers, specifiers and end-users of fire protection and prevention products. Entry is free and visitors can register online at www.fire-expo.co.uk, where the latest event information, news and latest seminar programmes are available. Attendees who pre-register will receive a free race day ticket on arrival. Companies interested in exhibiting at this year's event should contact Gerry Dunphy on +44 (0) 207 921 8063 or email: gdunphy@cmpinformation.com IFP

Rail Fire Protection

The rolling stock value chain of the railway industry is undergoing a profound transformation. A change headed by two acronyms: EN & TSI.

The Pan-European unified set of standards, combined with the current Fire Protection practices of railway companies, is poised to change the structure and outcome of the massive array of rolling stock & fire safety programmes. This will not only result in change through the industry supply chain, but also through the way rolling stock manufacturers and operators interact in the marketplace.

Knowing that there is an undeniable potential of fire protection effectiveness and rolling stock enhancement in implementing EN*45545,* the players from the railway and underground arena are focusing more and more on how to better achieve the interoperability process and technical harmonisation and gain ROI through improved safety programmes. Realising the benefits means, of course, meeting key challenges, such as: a mandatory change in engineering, exploitation and business processes that the fire safety norms` development implies and will prompt; defining further the regulatory frame, etc.

After thorough research with high-level industry players and organisations, we at VIB events are delighted to lead you beyond the EN & TSI hype-cycle, converting the general excitement about their implementation into a solid business real-world experience, through a savvy mix of real-life case studies and expertise, encompassing:

- Testing procedures under the new European Standards
- Tunnel safety in light of the transition from national regulations to a TSI
- Fire safety advancements in procurement & refurbishing projects
- Material selection & purchasing under the current standards and the new set of norms
- The use of stations` & tunnels` smoke exhaust systems in an underground context

and many more!

Whether you are a corporate decision-maker, researcher, or technology specialist; whether your company is actively overseeing advanced EN & TSI compliance projects, or is yet to deploy them, knowledge imparted at this conference will be invaluable.

Come and join our high-level expert panel, including representatives of DB, CEN, Ansaldobreda, RATP, Trenitalia, CAF – to name just a few – and get prepared to stay on the leading edge when the moment of EN mandatory implementation comes!

We at VIB events look forward to welcoming you to London on 8th–9th of March 2006, for this important and inspirational industry event!

A special discount of 10% will be offered to all IFP readers. IFP

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For further information please visit:
www.transportresource.com/fireprotection
Email: events@vibevents or call 0044 (0) 207 753 4268 quoting reference "IFP"


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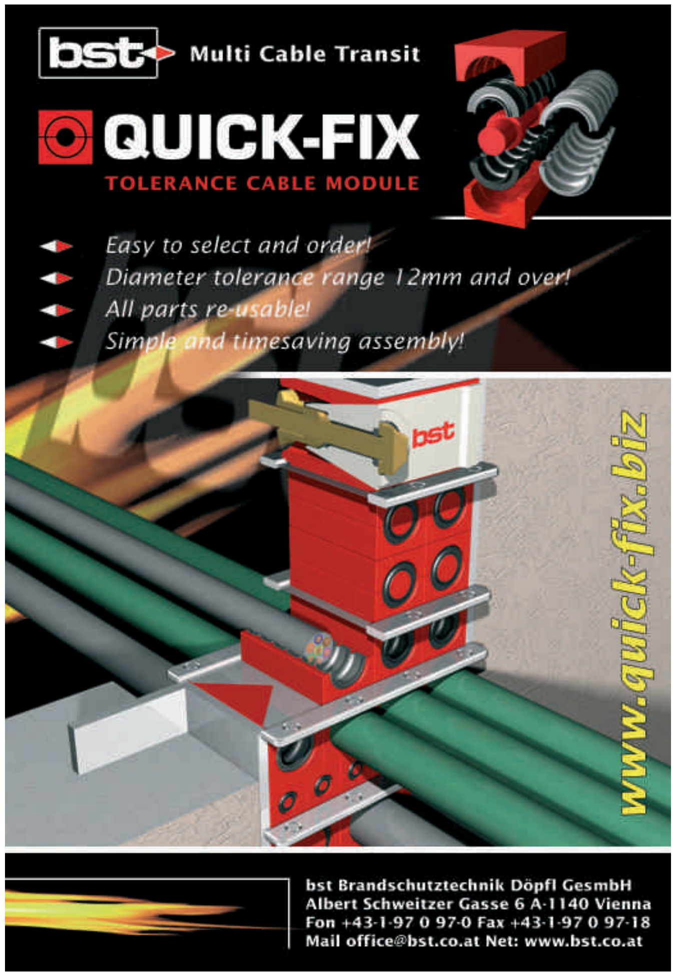
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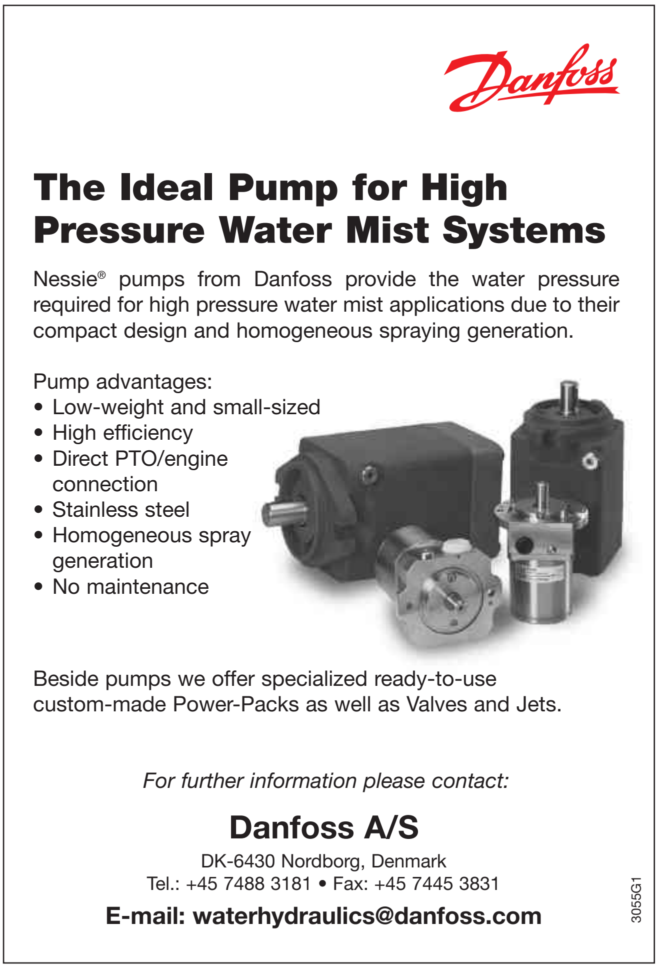
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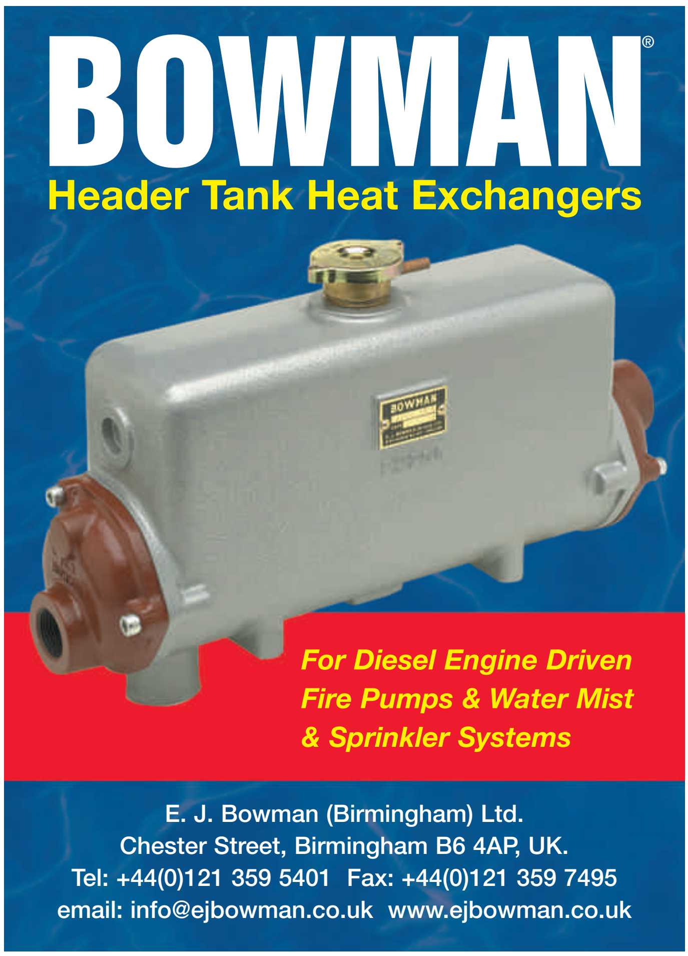
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New on-site testing facilities put fire fighting enterprises ahead of the game

Smoke detector specialist FFE's recent move to larger premises has enabled the installation of new on-site testing facilities to further improve the company's analysis and product development capabilities.

The new environmental chamber simulates the effects of age on the company's optical smoke beam detector units by cycling them through a wide range of temperature and humidity conditions. This replicates on-site conditions and ensures all of the components in the product are robust enough to withstand the rigours of constant use. The chamber can also be used to ensure that products can operate effectively at temperature extremes.

Ian Steel, FFE's Marketing Manager commented, "The test facilities in our new premises represent a big step forward for the company. We hope their introduction will show our customers that we are dedicated to continual testing and improvement."

FFE has been a leader in the manufacture of infra-red optical smoke beam detectors for over thirty years and continues to enjoy an excellent reputation for the supply of fire detection products within the global fire industry.

For more information please visit FFE's website at www.ffeuk.com

Kidde Protects Durham Cathedral

A KIDDE FIRE PROTECTION HART™ XL Aspirating Smoke Detection system has been installed in Durham Cathedral.

Early fire detection is crucial in the 900 year old building, which is designated a World Heritage Site and contains many precious artefacts including the relics of St Cuthbert and the Venerable Bede.

The HART™ XL system works by continually drawing air from the protected nave and choir areas into a pipe network and transporting it to six detectors. Unique laser technology detects any smoke and measures it against alert and alarm thresholds programmed into a fire control panel.

Commenting on the system, Kidde Fire Protection's Chief System Designer – Phil Barton said, "It is designed to be as unobtrusive as possible to preserve the appearance of the building. Two detectors are concealed in the roof void and four in the 'triforium' or gallery above the arches. Air sampling points are provided by tiny capillary tubes that branch off from the main pipe network and project over the triforium and through small holes in the ceiling."

Derek Addison, Technical Director of Marbco Fire & Safety, managed the installation. "The height and volume of the building and its fluctuating airflow meant we had to conduct several smoke tests at the design and commissioning stages to ensure optimum performance" he said.

"The HART™ XL system provides the earliest possible warning of a fire" said Jon Williams, who is responsible for fire safety at the Cathedral. "It is barely discernible from ground level and it is ideal for an historic building where access for servicing is difficult and where an unobtrusive appearance, reliability and cost effectiveness are critical."

About Kidde Fire Protection

Kidde Fire Protection manufactures clean agent fire suppression systems at Bentham, North Yorkshire, and electronic fire detection and alarm equipment at Peterlee, County Durham. It provides product sales and customer support from Thame, near Oxford. It is part of the British company Kidde Products Limited, which in turn is part of UTC Fire & Security, a United Technologies Corp. (NYSE:UTX) business unit that provides fire safety and security solutions to more than one million customers around the world. UTC Fire & Security is headquartered in Connecticut, USA.

For further information contact:
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Marketing moves at No Climb

NO CLIMB PRODUCTS LIMITED, the world's leading manufacturer of professional test and service equipment for fire detection systems, has expanded its marketing department with the appointment of Stephen Beadle as Marketing Co-ordinator.

Stephen, who prior to joining No Climb, worked in marketing within the software development arena, will assist with the promotion of new products and the strengthening of the No Climb brand within the global marketplace.

"Our new product development plans and sales growth have resulted in increased marketing demands", said Caryn Cooper, Marketing Manager at No Climb "I am delighted to welcome Stephen, whose experience will be vital in helping us deliver the best to our customers."

For further information, please contact:
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Email: stephen.beadle@noclimb.com
Website: www.detectortesters.com

FM-200® Waterless Fire Protection Update

By Al Thornton

As the climate debate wages on, there is much confusion about the safety and environmental impact of fire suppressants. Most of the confusion is a result of rumors and misinformation. Some of this confusion dates back to the phase out of ozone-depleting CFCs and HCFCs in the early 1990's.

Al Thornton, a Regional Manager for Great Lakes Chemical Corporation, A Chemtura Company, is President of the Fire Suppression Systems Association, an organization dedicated to protecting high value assets from fire and water damage. He also serves on the NFPA Gaseous Fire Extinguishing Systems Committee and the U.S. Technical Advisory Group to ISO TC21/SC8, Gaseous Fire Extinguishing Systems.

For more information, please contact:
Karen Brown
Email:
karen.brown@chemtura.com
Tel: 502-426-1264

No Safety or Environmental Concerns

FM-200 Waterless Fire Protection was created in response to the phase-out of ozone depleting CFCs such as Halon 1301 to meet provisions of the Montreal Protocol. FM-200 does not deplete stratospheric ozone and is approved for use worldwide including countries with some of the toughest environmental standards.

Regulatory agencies in Germany, Australia, France, Russia, and the United Kingdom have reviewed extensive toxicology studies. In every case, FM-200 has been judged safe for use in occupied spaces. In fact, FM-200 is so safe that the compound is approved as a propellant for medical inhalers.

Respected and Approved Worldwide

FM-200 systems are tested and approved by independent third party testing laboratories, such as Underwriters Laboratory (UL), Factory Mutual (FM), VdS, CNP, and LPC. Rigorous performance testing has been completed by leading technical organizations including the U.S. Navy, U.S. Coast Guard, U.S. Army, and Canada's National Research Lab among others.

How FM-200® Systems Work

Effective on Class A, B, and C fires, FM-200 extinguishes fires quickly through a combination of chemical interaction and physical heat removal. FM-200 does not smother flames by removing oxygen. It removes heat energy from the fire, not oxygen from the environment. FM-200 absorbs heat from the flame zone and interrupts the chemical chain reaction of the combustion process.

Stored as a liquid in pressurized cylinders, FM-200 flows through a piping network to a discharge nozzle where it is deployed as a gas. The amount of FM-200 delivered to each nozzle is carefully calculated to ensure the appropriate concentration level. Systems are designed for uniform distribution throughout the protected area. FM-200 gas penetrates with three-dimensional capability, easily reaching into obscure or hard to reach areas.

The primary objective of an FM-200 system is to detect and extinguish a fire in its incipient stage long before smoke generation causes damage. Fire often begins before you see smoke or fire or feel intense heat. This is the incipient stage of fire development. When fires are stopped at the incipient stage, the risk of explosion, production of toxic combustion by-products and extensive damage are eliminated. Delays usually result in loss of lives, increased damage, and downtime.

FM-200 systems encompass two functions: the detection/notification of a fire at its incipient stage and the subsequent suppression of that fire. Detection systems rely on various types of detectors to sense either smoke, flame, heat or the presence of combustion by-products. Different applications will require different types of detection devices. With incipient fire detection and intelligent alarm panels, an FM-200 system can detect overheating electrical wire before it reaches a flash point.

Unlike water, FM-200 is non-conductive and non-corrosive making it safe to use around electronics and electrical equipment. There is no collateral damage, no residue to clean up, and no downtime.

EPA's new National Computer Center installed FM-200® systems to protect its valuable supercomputers and data.

Conclusion

Today's marketplace is more confusing and more competitive. So when evaluating waterless fire protection systems, get the facts. Ask for customer lists, approvals, test data, manufacturing standards and specific regulations. When you have all the facts, it's easy to understand why FM-200 with over a decade of unmatched field performance continues to be the market leader. IFP

Vetrotech Saint-Gobain Provides FireShield for King's College Hospital

In the event of fire, two things need to happen. First, the fire must be contained to minimise the risk of it spreading. Second, those at risk need to be evacuated quickly and safely. Both require fire resisting glass: to trap the fire and toxic fumes in its point of origin and to provide protected passages from the building.

Those twin objectives are nowhere more pronounced than in a hospital, where patients may be unable to escape unaided, therefore extending the period necessary for safe evacuation. For a hospital, building in margins of fire safety therefore requires a higher dimension of active and passive fire measures.

That higher dimension can be seen at King's College Hospital, London, where VETROTECH SAINT-GOBAIN, has supplied specialist products.

The Golden Jubilee Wing, designed by Nightingale Associates, is situated on the south London hospital's main site at Demark Hill and involved fire glass being installed on the perimeter walls of a central atrium, a link bridge across the atrium, internal dividing partitions and front entrance and secondary door systems.

The installation was carried out by Mildenhall-based EAG (English Architectural Glazing) Limited which, has a reputation in the industry for delivering quality at competitive rates.

In total, FireShield Glazing Limited installed nearly 600 sq metres of SGG Pyroswiss, SGG Pyroswiss Extra, SGG Contraflam and SGG Swissflam Lite on the project.

The combination of fire glasses used in the contract underlines the ability of Vetrotech Saint-Gobain, with its

comprehensive range of glass products, to meet varying specifications for fire resistance.

All Vetrotech Saint-Gobain glasses are Class A products and, for the King's College Hospital contract, provided from 30 minutes of fire resistance to 120 minutes of fire resistance integrity (SGG Pyroswiss Extra), to 60 minutes integrity and insulation (SGG Contraflam).

For further information please contact your local Vetrotech Saint-Gobain sales Office or visit our website www.vetrotech.com

New Fire Rated Webbseal Products

The Trade Division of ILLBRUCK SEALANT SYSTEMS UK LTD. has added three new high performance fire-rated products to its Webbseal branded range of sealants.

Webbseal FR-S is a fire-rated, silicone sealant for durable fire resistance applications that also require high movement accommodation, such as perimeter, movement and expansion joints.

Tested to BS 476 Parts 20 and 22, the product is a one-component, neutral-curing cartridge sealant that can also be used to cap other materials to enhance fire resistance properties.

Webbseal FR-A is a one-part, acrylic-based, fire-rated sealant that is intended for sealing joints, voids and irregular holes in firewalls, partitions and other structures.

This fast curing, emulsion acrylic formulation is particularly suitable for maintaining structural integrity when sealing around pipe and cable penetrations and is ideal for perimeter pointing around fire door frames and windows.

Also now available in the Webbseal range is the Webbseal FR Acoustic Intumescent sealant, which is supplied in a special 830ml jumbo cartridge for high volume applications. The dense, non-toxic material combines permanently flexible sealing properties with effective sound insulation and is designed for internal use where it provides a fire-proof joint seal in addition to providing acoustic insulation.

These three new, fire-rated products further extend the comprehensive range of Webbseal professional sealants, expanding PU foams, gap filling and contact adhesives.

Fore more information please contact,
illbruck Sealant Systems UK Ltd
Tel: +44 (0) 191 419 0505
Website: www.webbseal.com

First LPCB seal of approval for Klaxon's Sonos Products

Several products from KLAXON SIGNALS Sonos range of multipurpose fire alarm sounders have been approved by the Loss Prevention Certification Board. DC Sonos units will now be issued with the LPCB quality mark and an approval number, 717a.

The DC Sonos has an LED beacon which draws significantly less current than traditional xenon beacons. It is optimised for fire applications and is available as either a beacon or a sounder-beacon.

Kristian Johnson, Klaxon's Marketing Manager, remarked, "We are pleased to announce this approval and hope that it shows our customers we are dedicated to continual third party testing. We expect to receive approval on the rest of the Sonos range in the near future."

All products in the Sonos range are available in deep or shallow base variants. Deep base units have weatherproof protection to IP65 and can be used in all locations, both indoors and outdoors.

Units are available in either red or white and come with a choice of 32 tones including all the major European standards, making them suitable for use across Europe. The tone and volume setting can be preset or adjusted 'off-base.'

For more information please contact:
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Industrial Asset Protection

Based on Teesside and responsible for protecting most of the high hazard industrial assets in one of Britain's industrial heartlands for over 50 years, SembCorp's Asset Protection and Logistics (AP&L) team has a reputation second to none.

By Paul Frankland

Business Development Manager
Asset Protection

Partnership is the key to our success. This approach has enabled us to develop and maintain close working relationships not only with their colleagues in the county emergency services, as you would expect, but also with our customers. As a result I believe that we provide a fully integrated emergency response service to the highest standards.

The Asset Protection and Logistics team is totally focused on providing a 'one stop shop' emergency response package. Our vast experience combined with the fact that we practice what we preach, means that we are well placed to assist in helping you to protect your business and reputation Whether it's in advising on risk assessment, developing and planning emergency response arrangements, exercising, training, or employing the latest fire protection and engineering equipment, we can tailor our services to meet your requirements.

PACT: PROTECTION, AUDITING, CONSULTANCY AND TRAINING

The success of SembCorp's Protection, Auditing, Consultancy and Training (PACT) products has seen the company make significant investment in developing a new stand alone sub business within the larger emergency response organisation.

Headed up by Business Development Manager Paul Frankland, the PACT business aims to provide solutions to clients in all aspects of their emergency preparedness.

Business Concept

The concept of the business is to create a service based business unit which:

- Is prepared to physically invest in the emergency response infrastructure to enhance the protection of customer assets – Protection
- Helps clients to understand their strengths and areas which need improving in protecting their assets – Audit
- Advises on and helps them to implement the improvements needed – Consulting
- Prepares people in the client company for excellence in protecting their assets and readiness for emergencies –Training.

A team of experienced emergency preparedness consultants with current practitioner experience is available to provide services from a total

outsourced solution, i.e. provision of operational firefighters and medical staff through to the delivery of training and exercising programmes. Because the consultants are currently providing operational services to clients they fully understand how legislation and economics impact on managing incidents. PACT is best placed to advise and support clients who need to make best use of the resources available to them in a very demanding economic environment.

All levels of incident response are catered for, starting with operational training for key members of staff at the sharp end, through to strategic level training for senior managers, ensuring business continuity and enhanced resilience.

Few organisations could be better qualified to deliver these solutions having been responsible for the protection of some of the world's largest production units during the past 50 years operating on one of Europe's biggest chemical parks.

All levels of incident response are catered for, starting with operational training for key members of staff at the sharp end, through to strategic level training for senior managers, ensuring business continuity and enhanced resilience.

Extensive Experience

SembCorp has extensive experience in working with small scale clients through major industrial leaders in the petrochemical, nuclear, pharmaceutical, heavy manufacturing and government sectors. Underpinning the PACT business is a wealth of experience to deliver clients' needs in fire engineering, certification, auditing, risks assessment, consequence analysis, media skills and management of environmental incidents.

In order to provide clients with a fully managed

service, business specific raining is also offered in areas such as: first aid; kinetic handling; general safety, fire prevention security management, confined space and conflict management.

The credibility of the team and products has been validated by the development of alliances with organisations such as Lancashire Fire and Rescue Service, United Kingdom Onshore Pipeline Association (UKOPA) and the Joint Oil Industry Fire Forum (JOIFF).

PROTECTION: AT THE HEART OF EMERGENCY RESPONSE

Asset Protection and Logistics' rapid response unit is truly a force to be reckoned with. With highly trained men and women and some of the world's finest fire fighting and spill protection equipment, the Asset Protection (AP) element is justifiably confident in its ability to deliver top quality service to its customers, 24 hours a day, 365 days a year.

Effective Response

To be able to respond so effectively, AP needs specialised equipment and consequently has access to the largest industrial stocks of foam in the UK, with around 200,000l of ARAFFF foam concentrate on site at any given time. Senior health, safety and environmental managers as well as major insurers regularly visit the site o audit the team and witness site exercises and occasional real events give the men and women the opportunity to put everything they've learned in training into practice.

Background

Originally the emergency response provision on the three Teesside sites – Wilton, Billingham and North Tees – were managed and controlled independently. In 1998 a project was established and delivered to operate a single control centre based on the Wilton International site. This delivered a number of significant benefits. There was an obvious financial benefit due to the reduction in the number of operators for a single control centre and operationally a single process of management of emergencies was established. Training and competencies of the operators has increased as information technology has advanced.

The team at AP believe this is a best practice approach for delivering a 'one stop shop' for emergency response and preparedness on Teesside and would be keen to deliver the same concept at other key industrial sites.

AP&L is currently looking to provide a range of services outside of the current Teesside sites, including delivering bespoke outsourced emergency response services to auditing, training and consultancy – see our PACT report.

VMDS: MOBILE DATA BASED RISK ASSESSMENT

SembCorp's Asset Protection & Logistics Group (AP&L) has provided emergence response, in particular fire fighting to the petrochemical plants on Teesside, for over 50 years. APL is proud of its heritage and that it continues providing the highest grade of service to its customers, utilising the very best in equipment and methodology.

AP&L thrives on being at the forefront of evolving Technology. Traditionally the group has always maintained he highest standards in manpower and machinery. It is this philosophy that has driven AP&L to develop its own unique version of an existing fire brigade risk assessment tool.

SembCorp's Vehicle Mounted Data System (VMDS) is a mobile data platform, mounted in all SembCorp front line industrial fire appliances. Its primary aim is to minimise the risk of injury to mobile crews by using data within a Geographical Information System (GIS), enabling crews to be 'best prepared' when attending an incident.

The VMDS begins as an 'off the shelf' hardware and software solution; on going in house software improvements using SembCorp's sister business, SembUtilities Solutions, means that the system is developed bespoke to the company's own requirements, providing an ever evolving design.

Ease of information access is a critical part of its functionality. One example is intuitive icons which designed to look like the data being retrieved, e.g.: hydrants; building layouts; run a hose – within seconds he user can determine hose lengths from supply to front-line; position equipment – virtual drawing pins for positioning of assets at he scene; plot zones – as part of he incident control process the VMDS can be used to ascertain areas of variable risk levels determining high hazard zones and decontamination areas; and hotlinks o any data source, file type or additional information resource –e.g. CAD layouts (for entry into building fires, with the inherent risks associated with a complex building layout), ChemData, tactical information plans.

Detailed information

SembCorp's team manages data capture in house. AP&L's system required the GPS positioning of over 2400 valves, hydrants and sumps and 300km of raw water network. Together with other detailed information on building design and structure, firewater supplies, high risk areas and priority isolations, are now available at he push of a button.

Fire plans, hazard data sheets, procedural instructions, COMAH case studies, environmental procedures can also be accessed depending on the requirements of he customer and the incident. In addition the VMDS can be used dynamically (at he scene, in real time)by one of SembCorp's on call, highly qualified fire engineers (operational fire officers) to assist in the data population process, e.g. creation of fire plans bespoke to the incident.

Latest Information

Appliances take an offline version of he GIS within he VMDS that is regularly synchronised ensuring that hose responding to an incident have the latest information available.

System philosophy being one of early detection and rapid response, VMDS offers the user a major step forward in rapid response capability. It provides front line firefighters with all the information they need to ensure their preplanned response is carried out effectively. As everyone knows, seconds can make a difference to the amount of damage caused to assets during a fire. IFP

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Industrial Firefighting Foams:

Selecting the Right Foam System

While foam has been used for industrial fire fighting for decades, there is more to selecting the right foam than might first meet the eye. Here, Peter Kristenson, Product Manager for foam products at Tyco Fire and Security's Fire Suppression Group, which designs and manufactures sophisticated foam-based firefighting systems, explores some of the issues affecting system selection and the latest foam agents to come onto the market.

By Peter Kristenson

Product Manager for foam products at Tyco Fire and Security's Fire Suppression Group

Basically, firefighting foam is a mixture of water, foam concentrate and air; a stable mass of small, air-filled bubbles that has a lower density than oil, petrol, or water. The foam concentrate is injected into the water by means of a foam concentrate proportioning unit, and the resulting blend is fed to a foam generator. In most cases this is located at the end of the pipe or hose that is used to deliver the mixture. The foam generator sucks-in air, which combines with the liquid mixture to create the firefighting foam.

Foam separates the fuel from the oxygen; it effectively smothers the fire, while its high water content provides effective cooling. Well-formulated foam, correctly applied, exhibits a number of characteristics. These include stability, cohesion, rapid fire-knockdown, heat resistance and vapour suppression; all of which will ensure that a fire is extinguished efficiently and securely to prevent reignition.

In essence there are three categories of foam, which are determined by the volume of foam that is created by a given amount of water. These are low expansion foam or Low-Ex; medium expansion foam or Med-Ex; and high expansion foam or Hi-Ex. Low-Ex foam has an expansion factor of up to 20; Med-Ex a factor between 20 and 200; and Hi-Ex a factor higher than 200.

Low-Ex foam is often generated using equipment such as a foam monitor, a foam branch pipe or a foam sprinkler, while Med-Ex foam uses a Med-Ex foam branch pipe or a Med-Ex sprinkler. A Hi-Ex generator is used to create Hi-Ex foam, and this usually incorporates a fan that ensures that the required amount of air is available for the foam production. This fan can be driven by a petrol or diesel engine, or by a water turbine, but electricity is the most common power source for conventional fixed installations in enclosed areas.

Firefighting foam options

There have, in recent years, been many advances in the field of foam concentrates, and some suppliers have been somewhat over enthusiastic when promoting their own type of generic product, the formulation of which has been dependent upon the company's manufacturing capability.

However, it is important to be aware of the wide range of foam formulations that are available today. These range from the low cost but highly stable protein foams, through to the latest leading-edge synthetic products, such as Tyco's Thunderstorm 1 x 3, which was developed in consultation with Williams Fire and Hazard Control Inc, probably the world's most highly respected specialist in the fire protection of flammable liquids. Briefly though, the types of foam currently on the market can be categorised as protein foams; fluoroprotein foams; aqueous film forming foams (AFFF); film forming fluoroprotein foams; and alcohol resistant concentrates.

Of course, it is not merely a matter of selecting the type of foam, critically important though that is; it is equally essential to decide on a supplier of foam concentrate and provider of delivery systems. And this must be a decision that is not based on cost alone! Continuity of supply, technical support, engineering know-how, manufacturing resources and industry expertise all have to be assessed.

It is important to be aware of the wide range of foam formulations that are available today. These range from the low cost but highly stable protein foams, through to the latest leading-edge synthetic products.

High expansion foam systems

Due to the often-hazardous nature of the content many warehouses and distribution centres, they represent a significant potential fire risk and foam systems are increasingly being seen as the most suitable firefighting solution. This is particularly so where flammable liquids are stored or used during the manufacturing process.

In these often-voluminous structures, high expansion foam is the ideal choice owing to its low water content, which will minimise the damage to paper or board packaging. This is because, for each litre of water used, between 600 litres and 1000 litres of foam bubbles are generated

A Hi-Ex foam will rapidly – within minutes of its release – completely fill the space in which the fire has occurred, and so extinguish the blaze. However, only synthetic foam concentrates can be applied, and the performance of a Hi-Ex foam system is highly dependent on the quality of the foam concentrate that is used.

Hi-Ex foam extinguishes a fire in several ways. The water within the foam is turned into steam and contributes towards to a rapid cooling of the fire; the steam also acts as an inerting agent and reduces the oxygen content of the air; the excellent isolating function of Hi-Ex foam prevents heat from spreading and setting other objects alight; and the foam prevents flammable gases from spreading and igniting.

To produce the foam, a conventional Hi-Ex system takes fresh air from outside the protected area and, as the foam is discharged into the protected area, a corresponding amount of air must be ventilated out of this space. This is usually achieved by using a smoke ventilation system. A characteristic of a Hi-Ex system is that the total amount of water required to extinguish a fire is, in relative terms, small, so the total amount of extinguishing media to be cleaned up once the fire has been extinguished is also minimised.

Hotfoam warehouse protection

More than a decade ago, Tyco pioneered the technology of producing Hi-Ex foam using smoke-contaminated air. Early tests proved that the introduction of smoke gases in the air supply to

conventional Hi-Ex generators reduced, or completely eliminated, the need for foam production by the generator. The same is true if the air supply, in addition to containing smoke, gas and particles, is also very hot.

This development programme led to the introduction of Hi-Ex foam generators that have no moving parts, and to a new, specially-formulated foam concentrate, from which a good quality foam can be produced under these very challenging conditions.

The outcome was the introduction by Tyco of Skum HotFoam, which operates on very different principles to conventional Hi-Ex systems. With HotFoam, the foam generators – which do not require power in any form – are located inside the protected space, using the air and smoke from the fire itself to generate foam bubbles. This does away with the need for an external fresh air supply for the foam production, and provides the flexibility and effectiveness often required for warehouse protection. In addition, the rapid knock-down of the flames and heat helps to minimise damage to the building structure and its contents. HotFoam can be effectively used on both hydrocarbon and polar solvent liquids, as well as solid combustibles, such as rubber, plastic, wood, paper and chemicals.

The foam generators – which do not require power in any form – are located inside the protected space, using the air and smoke from the fire itself to generate foam bubbles.

Typical applications for HotFoam include indoor

hazardous areas, such as chemical and petrochemical processing plants, warehouses, and flammable material production facilities. Other applications include tunnels – including cable tunnels, vehicle and rail tunnels – transformer stations and any spaces where an efficient fire fighting system is required that utilises a minimum amount of water.

The foam station for a HotFoam system consists of a water source; water pump: foam proportioner; Skum's Meteor P foam concentrate; a foam concentrate tank; the HotFoam control system; valves; fittings and piping; and the HotFoam generators. As with conventional Hi-Ex foams, HotFoam provides quick and effective extinguishing of a fire and has low water consumption.

A HotFoam installation requires minimal maintenance; air ducts, wall openings and additional smoke ventilation is not called for; pipe positioning is simplified; a pump with only a small capacity is needed; and there is considerable flexibility regarding the positioning of the HotFoam foam generators. Other benefits include simplified installation, since the low-weight generators can be hung directly in the supply pipes; simultaneous foam production over the entire protected area; and reduced emissions of smoke gases.

Other applications include tunnels – including cable tunnels, vehicle and rail tunnels – transformer stations and any spaces where an efficient fire fighting system is required that utilises a minimum amount of water.

The system is now approved by the Dutch authorities for fire fighting in areas such as warehouses that contain hazardous materials. SP, the Swedish National Testing and Research Institute, has verified the system for ships' engine rooms, and HotFoam is now approved by all of the major maritime classification societies, including DnV [Det Norske Veritas]; ABS [American Bureau of Shipping]; BV [Bureau Veritas]; GL [Germanischer Lloyd]; LRS [Lloyds Register of Shipping]; RINA [Registro Italiano Navale]; and NMD [Norwegian Maritime Directorate].

Foam sprinklers for industrial applications

An alternative to the use of either Hi-Ex foam or HotFoam for industrial applications is a foam sprinkler system. This is where discharge heads are sealed with a frangible bulb or a fusible link, which breaks at a pre-determined temperature. Here, the discharge heads additionally serve as the detectors, and only the heads that are actuated discharge the foam in the local area, so minimising water damage. This type of foam firefighting solution is mainly used for flammable liquids or general warehouses, process plants and material handling areas.

A foam sprinkler system can also use what are termed "open head sprinklers". These are activated via a deluge valve for simultaneous operation of all of the discharge heads. This type of installation is more typically used to protect road or rail loading racks, aircraft hangars and horizontal storage tanks.

Historically, the main problem with foam sprinkler systems has been the accuracy of the foam proportioning. Traditionally, this had been difficult to achieve, as it was impossible to know how many discharge heads will operate in the event of a fire; the actual flow rate could not be predicted with any real degree of accuracy. This has been overcome by Skum with the development of a unique range of what are known as "wide range proportioners", both for bladder tank and pressure proportioning systems. These proportioners have been successfully used for the better part of ten years and are specially designed for ATC – alcohol type concentrate – foam concentrates, helping to ensure that a foam sprinkler system will function correctly under all possible operating conditions. IFP

Hazardous Environment Response using a "Mission Control" Approach

On January 6, 2005, a 42-car train traveling through Graniteville, South Carolina crashed into a parked locomotive. A number of the cars contained hazardous chemicals: resins, kaolin and sodium hydroxide. Three cars were 90-ton tank cars, each carrying full loads of chlorine. Only one cracked, almost immediately releasing 80 tons of chlorine gas. During the immediate aftermath and over the next 10 days of cleanup there were over 600 casualties and nine fatalities.

By Andrew Balaschak

Senior Product Marketing Manager

and

Bob Durstenfeld

Director of Corporate Marketing, RAE Systems, San Jose, California

Although Graniteville represented the largest chemical release in the United States in 27 years[1], it was just one example of situations where first responders used a rapidly deployable, wireless hazardous materials detection system to protect life and property. Rapidly deployable wireless gas detectors were used to form a perimeter around the incident. The wireless system remained in place for well over the week required to contain and remediate the accident. Monitored from a remote command center, the monitoring system allowed first responders to focus on the critical tasks of saving lives without the need to station a person in protective gear to monitor each instrument locally.

Moving Away From "One-man, One-meter"

The convergence of three technologies, gas and radiation detection, wireless communications, and powerful computers, has fostered the creation of an entirely new tool for first responders: *The Rapid Deployment Hazardous Environment Detection System*. The ability to integrate these detectors, using wireless communications, into a centrally controlled system now allows first responders to be more effective than ever in dealing with threats. These systems give first responders the ability to move monitoring from a "one-man, one-meter" model to a "mission control" model.

Developed in partnership with leading first responder organizations, wireless hazardous detection systems have been widely adopted. They are used daily to respond to emergencies, providing reliable real-time, on-scene data. They are used to monitor refineries, chemical plants, and other industrial facilities, as well as in ad-hoc hazard situations, including the air monitoring of public venues during major events.

Terrorist Attack or Accidental Chemical Release

The difference between attack and accident is one of intent, but to the first responder the task remains the same – the preservation of life and property. Wireless hazardous environment detection systems have been deployed by first responders, law enforcement, government agencies and industrial users to protect the public at numerous incidents and major events. Key elements of an effective system should:

- Deliver rapidly deployable monitoring of a spill or accident while allowing personnel in the incident command center to remain at a safe distance and evaluate the need for personal protective equipment (PPE).

Wireless hazardous environment detection systems have been deployed by first responders, law enforcement, government agencies and industrial users to protect the public at numerous incidents and major events.

[1]Carolina Fire Rescue EMS Journal, Fall 2005

- Delineate a safe operating zone, inside which PPE should be worn while the incident is being contained and cleaned up.
- Model and predict a vapor plume in the broader region so that evacuations can be coordinated and minimized to only the necessary zones to save both time and money.
- Provide community awareness during a toxic release and the ability to measure the resulting plume.

Facility and Venue Protection
In addition to responding to HazMat incidents, there is increasing security focus on high-profile public buildings and special-venue protection. Wireless hazardous environment detection platforms combining chemical and radiation detection are ideally suited for rapid, scalable, and highly adaptable deployment at a wide variety of l-ocations that require security against terrorist threats or industrial accidents. Wireless systems have been used to protect over 100 major public events around the world. Environmental monitoring, using multiple, wireless monitors, at events can alert security personnel and first responders to dangers and provide time and life critical information to help make evacuation or shelter decisions.

Essential Elements of a Rapid Deployment System
Rapid deployment wireless systems have been in service with first responders for only three years. Since the development and deployment of these solutions, key lessons have been learned about the essential system elements needed for effective response to both intended and accidental hazardous incidents:

- A complete line of field-proven monitors to meet a variety of needs
- Portability and Rapid system deployment capability
- Flexible re-configuration with an open instrument and wireless platform
- Integrated weather information, GPS location and plume measurement
- Data portability

Let's look at each of these critical elements in more detail.

Wireless hazardous environment detection platforms combining chemical and radiation detection are ideally suited for rapid, scalable, and highly adaptable deployment at a wide variety of locations that require security against terrorist threats or industrial accidents.

A Complete Line of Field-Proven Products
The system should offer rugged, weather-resistant wireless gas and radiation monitors that can be field reconfigured to measure oxygen, combustibles, toxic industrial chemicals (TICs), gases, and gamma radiation. The monitors should be able to support Global Positioning (GPS) mapping.

Toxic gas sensors must be available for such chemicals as: ammonia, carbon monoxide, chlorine, hydrogen cyanide, hydrogen sulfide, nitrogen oxide, nitrogen dioxide, sulfur dioxide, and phosphine.

Photoionization detectors (PID) give early warning for a variety of volatile organic chemicals (VOCs) that might be of concern, such as fuels, pepper spray and some chemical warfare agents. PIDs also provide early indication of possible flammable compounds before an Lower Explosive Limit (LEL) sensor. An LEL sensor is useful for detecting most combustible gases such as hydrogen, propane, and methane. Many people consider the oxygen sensor as the ultimate broadband detector. As little as a one percent deficiency in atmospheric oxygen levels can be life-threatening, and an oxygen-rich environment increases the risk of explosion or fire. Further, a 0.1% decrease in oxygen concentration can indicate the potential presence of 5,000 parts-per-million of something else being present. Toxic gas sensors must be available for such chemicals as: ammonia, carbon monoxide, chlorine, hydrogen cyanide, hydrogen sulfide, nitrogen oxide, nitrogen dioxide, sulfur dioxide, and phosphine. Finally, a gamma radiation sensor must be available to warn of the presence of any dangerous radioactive material.

These instruments must operate on a robust wireless network capable of supporting a large number of monitors over a wide area with a proven host controller. They must provide GPS information so that their location is automatically identified on a map at the base station or command center. Additionally, the system must be an open platform that allows the integration of best-of-breed, third-party sensor solutions such as weather stations, chemical warfare agent detectors, and other applications.

It is important, however, to avoid being too integrated. For example, some sensors for chemical warfare agents (CWAs) are very sensitive, easily contaminated, expensive and specialized in their application. Standard operating procedures should use broadband sensors to show the existence of a threat prior to deploying specific sensors and identifiers.

Rapid System Deployment
Systems must be specifically designed for rapid deployment in temporary monitoring applications lasting a few hours, a few days or even weeks.


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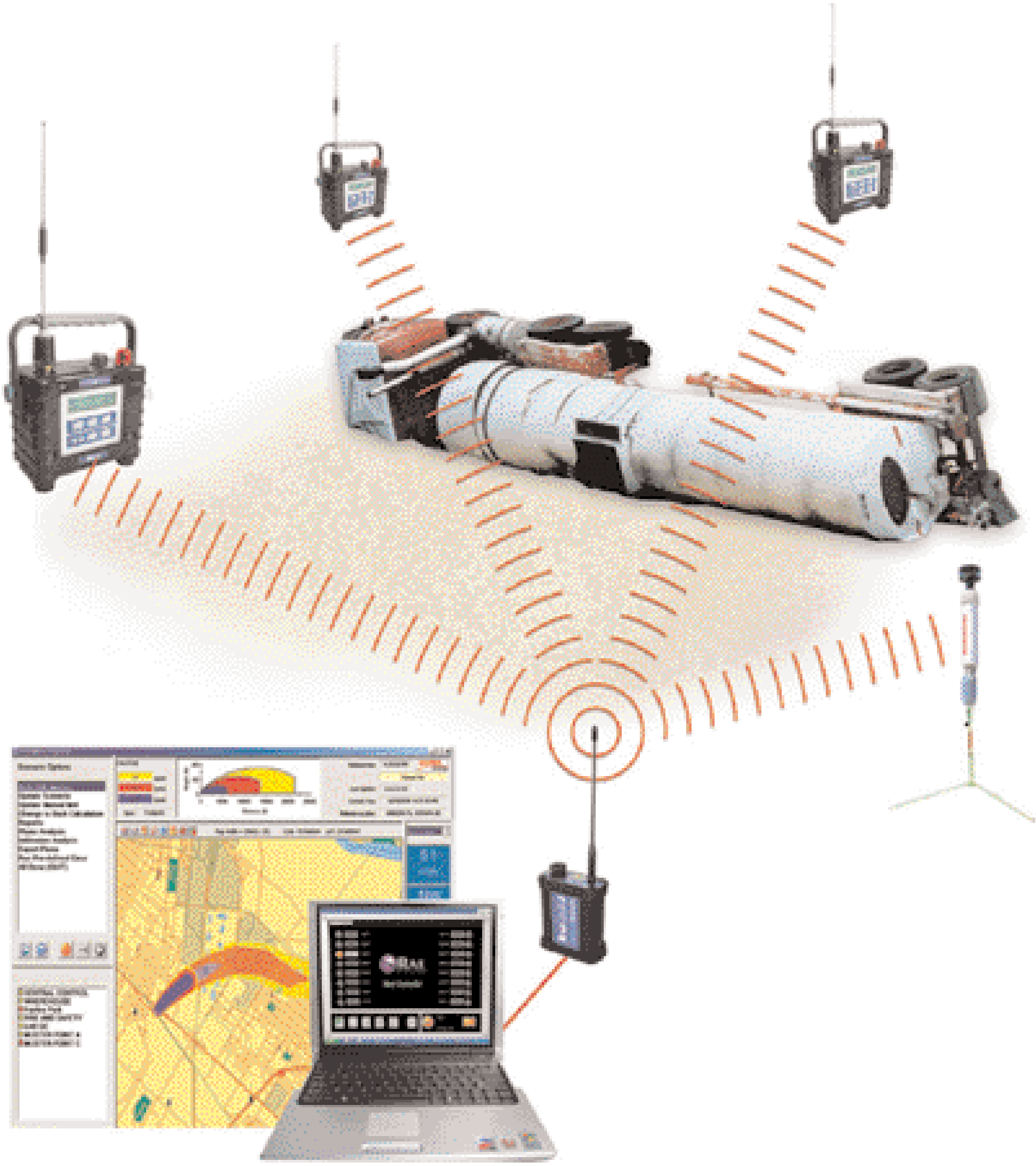

Considering that hazardous material response teams arrive on scene after an event, it is critical that the wireless system be deployed and be in service in less than five minutes. This rapid deployment is enabled through the integration of:

- Multiple sensors and the data radio or wireless modem in a single unit.
- Fast start-up of the wireless monitors.
- Automatic host controller set-up and network activation without the need for on-site software re-configuration.
- A robust wireless communications architecture. Highly specific communication means the system operates immediately. Communications that are secure and resistant to interference or jamming, and deliver a two-mile operational range.

Experienced wireless hazardous environment detection system vendors provide rapid deployment

kits designed for quick assessment and management of hazardous environments. These kits should include in-storage charging for both the wireless sensors and the host controller. These systems must scale up to 32 monitors to allow multiple agencies to combine resources. All these components must be transportable in rugged carrying cases.

Ease of Use

Above all, a rapid deployment system must be easy to use. Despite its wide-ranging capabilities, all of its operations should be controlled through icon-driven software on a single laptop personal computer (PC).

Flexible Configuration and an Open Platform

Because a rapid deployment system is designed to be quickly deployed in any response scenario, it must be able to accommodate a wide range of detection equipment. The system should be able to support both the system vendor's equipment and third-party devices, all easily integrated and operating wirelessly while providing data for incident commanders through a single user interface.

Integrated Weather Information and Plume Measurement

An integrated, wireless, portable weather station is another critical component of the system solution. The weather station must be able to be set up in seconds to provide on-site integrated weather information. An integrated weather station, real-time wireless gas monitoring and GPS combine with mapping and computation algorithms to enable true plume measurement, as opposed to traditional plume modeling.

The difference between plume modeling and plume measurement is the ability to "back-calculate" the chemical release rate based on measured weather and gas level information in real time. Traditional modeling solutions like ALOHA have required first responders to know the chemical release rate, something that is often impossible to estimate. A modern system only requires the time, location and chemical that is released.

Data Portability: A Powerful New Approach

Fixed sensing networks have often provided data portability, but portable, ad-hoc networks have never before been able to have their data displayed remotely. Rapid deployment hazardous environment detection systems change monitoring from a "one-man, one-meter" approach to a "mission control" scenario. Measurements from multiple sensors are transmitted by a wireless network to one location where they can not only be viewed on one computer, but transmitted to other locations worldwide, via the Internet, for simultaneous viewing. This provides enhanced safety for the responders, who can set sensors in place and move to a known safe location, plus it allows experts at remote locations to assist in monitoring and decision-support.

Traditional modeling solutions like ALOHA have required first responders to know the chemical release rate, something that is often impossible to estimate. A modern system only requires the time, location and chemical that is released.

By having all sensor data in one place, the incident commander can alert downrange personnel to hazardous changes while the downrange personnel remain mission focused on their operation tasks. In addition, data can be stored for later review and for future training.

Data portability provides instantaneous situational awareness in an Incident Command (IC) center. It also facilitates sensor "fusion" by providing the ability to employ multiple sensors to deliver a broad range of protection. By having all sensor data in one place, the incident commander can alert downrange personnel to hazardous changes while the downrange personnel remain mission focused on their operation tasks. In addition, data can be stored for later review and for future training.

Modern rapid deployment systems leverage the power of the Internet to aggregate multiple wireless networks, allowing access to critical information in real time from any location in the world. Because this data is truly portable, multiple viewers can simultaneously see and share current as well as historical data via a standard web browser on any computer.

Conclusion

The transition from "one-man, one-meter" to "mission control" is well under way. Modern rapid deployment hazardous environment detection systems have been in use for a number of years and have become widely accepted in the HazMat community in North America. Their proven performance has established their place in the first responder's "tool box." They have moved beyond the first responder application and into refineries and industrial plants, and they are currently used to protect people at many public venues. They have successfully changed the way in which we respond to many emergencies and will continue to change response procedures in the future. IFP

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Detection Techniques

Ionisation

Since the introduction of general purpose industrial smoke detectors in the early 1970's, the dominant technology used was Ionisation Chamber detection, due to the relative simplicity of designing and manufacturing these devices.

These detectors originally used Radium as an Ionising source, which was reasonably quickly changed to Americium 241 (in the mid 1970's), with a much lower Radioactivity level.

Ionisation chamber smoke detectors operate by ionising the air molecules within the chamber using a pre-dominantly alpha particle source. When smoke enters the chamber the alpha particles collide with the smoke particles rather than the air-molecules, and thus reduce then small current flowing through the chamber. This current reduction is measured and compared to a set threshold level, which when crossed, initiates the fire signal.

Ionisation Chamber Smoke Detectors (i.c.s.d) generally respond well to invisible aerosols produced by flaming fires (in addition to other invisible particles).

Optical/Photo-electric

These are a newer technology, which developed with the reduction of size of electronic components through the late 1970's and early 1980's. Point smoke detectors generally use the scatter-light principle, where the light generator (Normally Infra-Red LED) and the light detector (I.R. Photodiode) are physically offset. When smoke is not present in the chamber, the light from the LED is blocked from striking the sensing area of the photodiode.

When smoke enters the chamber, then the light scatters off the smoke particles to strike the photodiode. The signal generated by the photo-diode is amplified and compared with a set threshold value, which determines the fire condition.

Optical detectors are generally insensitive to flaming fires when compared to an ionization detector, and respond better to the larger grey particles generated by smouldering fires.

When smoke enters the chamber, then the light scatters off the smoke particles to strike the photodiode. The signal generated by the photo-diode is amplified and compared with a set threshold value, which determines the fire condition.

Heat Detectors

Within the industrial and commercial environments, there are certain areas where smoke detectors cannot be used (areas where vapours, dust or other air-born particulate matter is present).

These areas can be protected using heat detection. Point type heat detectors can use the following technologies:

- Bi-metallic strip: (two different metals bonded together, which expand at different rates when heated, thus physically bending to make a contact at a defined temperature).
- Air-bleed chamber: (the expansion of air within the sensing chamber which has a calibrated bleed hole. A steep temperature gradient will cause rapid expansion of air inside the chamber which the bleed hole is unable to accommodate, thus causing an electrical contact to be made).
- Thermistors: These are electronic components that change their resistance when heated (or cooled). This change can then be detected by other circuitry and compared with a set threshold value to operate a fire condition at a given temperature. Thermistor based heat detectors can be configured to have a fixed (static) operation temperature , rate-of–rise operation (if the rate at which the air temperature rises, exceeds a set rate for longer than a given time , then a fire condition is signalled), or both.

Within a product range, it is normal to offer a number of fixed operation temperature devices set to operate at different temperatures, (with or without rate-of rise operation), to cover all environments.

Multi-sensors

It is generally accepted that optical smoke detectors using the scattered light principle are today taking over the market where once ionization smoke detectors dominated, because the use of radioactive material for ionization smoke detectors has increasingly become controlled by regulation and legislation, and its use and handling restricted.

In general terms, an optical detector is insensitive to flaming fires when compared to an ionization detector.

To overcome this technology derived weak point of optical detectors, multi-sensor technology has recently been used as the most common solution. For instance, a heat sensor (thermistor) is used to sense a temperature rise, to be combined with the smoke signal from a scattered light I.R. optical, with a specific algorithm to increase the sensitivity of the Optical sensor as the temperature increases.

Dual Photo-Detectors

Generally speaking, the scattered light technology used for commercial detectors is unable to discriminate larger size particles like steam or dust, that are major causes of false alarms, from particles generated by combustion (Fire). Furthermore the optical detector is insensitive to flaming fires when compared to an ionization detector.

Multi-sensor technology has recently been used to try to offset some of these weak points, however they are still somewhat susceptible to false alarms caused by dust and steam.

As a quite different approach to solve these problems, we (Nittan Group) focused on Gustave Mie's (1868-1957) theory on particle light scatter-

Multi-sensor technology has recently been used to try to offset some of these weak points, however they are still somewhat susceptible to false alarms caused by dust and steam.

ing which was published in 1908. This theory suggested the possibility to discriminate smoke particles from non-combustion particles, by estimating the relative difference in particle size, by calculating the ratio of two scattered light sources of different wavelength's.

We expected that it would be possible to eliminate most of the false alarms caused by steam and dust, by discriminating these as large (non-combustion) particles. In addition, it would be possible to make this optical detector more sensitive to flaming fires, by shifting the alarm threshold level when the ratio of the two scattered light wavelengths indicated that the particle size present was similar to the smallest size defined as a smoke particle.

A practical implementation of this theoretical approach uses both Infra-Red and Blue LED's as light sources, to give the widest possible wavelength distribution, and a single photo-diode as the sensing element, and has proven through field trials to reduce false alarms due to steam.

CO (+ heat)

This technology is relatively new to the fire industry, with a number of manufacturers developing fire detection products. Testing has shown that CO from a fire may actually propagate better than smoke in some cases, but it should be noted that a number of fire types do not generate significant amounts of CO, and as such this technology should not be used to simply replace traditional smoke detection technologies.

However, it may well have benefits of early detection of fires, when used in conjunction with traditional smoke detection techniques.

The addition of a heat element to a CO detector can alleviate some of the weaknesses of a CO only detector, in that a combination of CO being present and temperature increase generates the fire signal.

Flame Detection

This method of fire detection is generally used in open areas, or where traditional point type smoke detectors cannot be used. When mounted in an explosion-proof housing, these devices can give fire protection coverage in sites such as oil refineries where fast detection of any fire outbreak is essential.

The two types of flame detector in general use are Ultra Violet (operating in the 185-260nm range) and Infra Red (operating at 4.3 m – (CO_2 resonant emission wavelength)), combined with a non-fire discrimination wavelength (4.0 m)

The addition of a heat element to a CO detector can alleviate some of the weaknesses of a CO only detector, in that a combination of CO being present and temperature increase generates the fire signal.

In addition these two types of sensor can be combined in a single housing in order to give a very fast response when a fire is detected, but since both sensors must give a fire condition, false alarm activation in a non-fire situation is reduced.

Beam Detection

Beam detectors are used in open areas, or atria and operate on either a Tranmissive or reflective obscuration effect, and can have operational ranges between 5m and 100m.

Transmissive beam detectors have the transmitter and receiver aligned opposite each other. If the Infra Red beam is obscured by smoke, at greater than a given level (i.e. 25%), then a fire signal is initiated. However if the obscuration signal is say greater than 80%, then the beam detector will generate a fault (in case a physical barrier has been inserted between the two devices).

It is normal practice to have to wire at least 2 wires between the Transmitter and Receiver (across the protected area).

Transmissive beam detectors have the transmitter and receiver aligned opposite each other. If the Infra Red beam is obscured by smoke, at greater than a given level (i.e. 25%), then a fire signal is initiated.

Reflective beam detectors operate on a similar principle, but the Transmitter and Receiver are mounted next to each other (normally in the same housing), and the light has to reflect off a reflector mounted opposite the device. This type does not require cables running across the protected area, but may have reduced sensitivity or operation range.

Video Detection

This is a very specialised type of smoke detection, using video or CCTV cameras, feeding video grabber boards, and connected to a PC running specialist analysis software. The software is designed to detect the movement of smoke particles, when stimulated by a heat source. This has applications where other open area smoke detection techniques prove to be un-suitable, or where the application is of exceptionally high value.

Linear Heat Detection

Again this is a specialised type of detection, using (normally) twin core steel conductors coated with a special heat sensitive polymer, then encased in a protective jacket. When exposed to heat at the specific alarm temperature the polymer deforms and allows the conductors to short together, thus generating the alarm signal. When connected to relevant monitoring equipment and EOL devices this detection cable can not only generate an alarm, but can also indicate how far down the cable (and thus the location) of where the fire is.

Standards

As a UK based company Nittan (UK) has experience of approving products to the EN54 series of European Product standards, which are then adopted as British Standards. In addition the UK has a Code of Practice (BS5839 series) which gives guidance on installation and location of detectors and Alarm equipment.

The UL (268 for Smoke detectors) standards and NFPA codes are the U.S equivalents of the EN and BS standards.

Other regions (and territories such as Australia, Japan etc) use their own standards series (i.e. AS and JIS) which vary depending upon national requirements.

Finally, there is the ISO 7240 series of product standards, which may be used if there is no other relevant national or regional standard which is applicable.

As a general rule, all these standards will define environmental, EMC, and performance criteria which the product must meet in order to be third party type approved, for sale or distribution within the relevant region/territory. IFP

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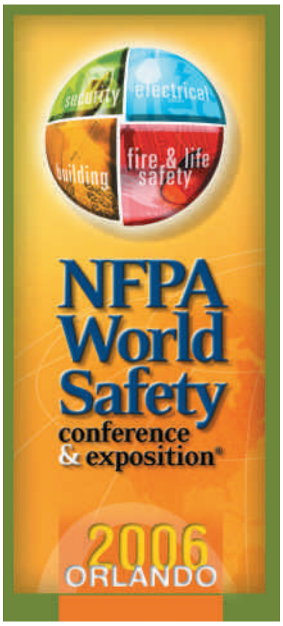


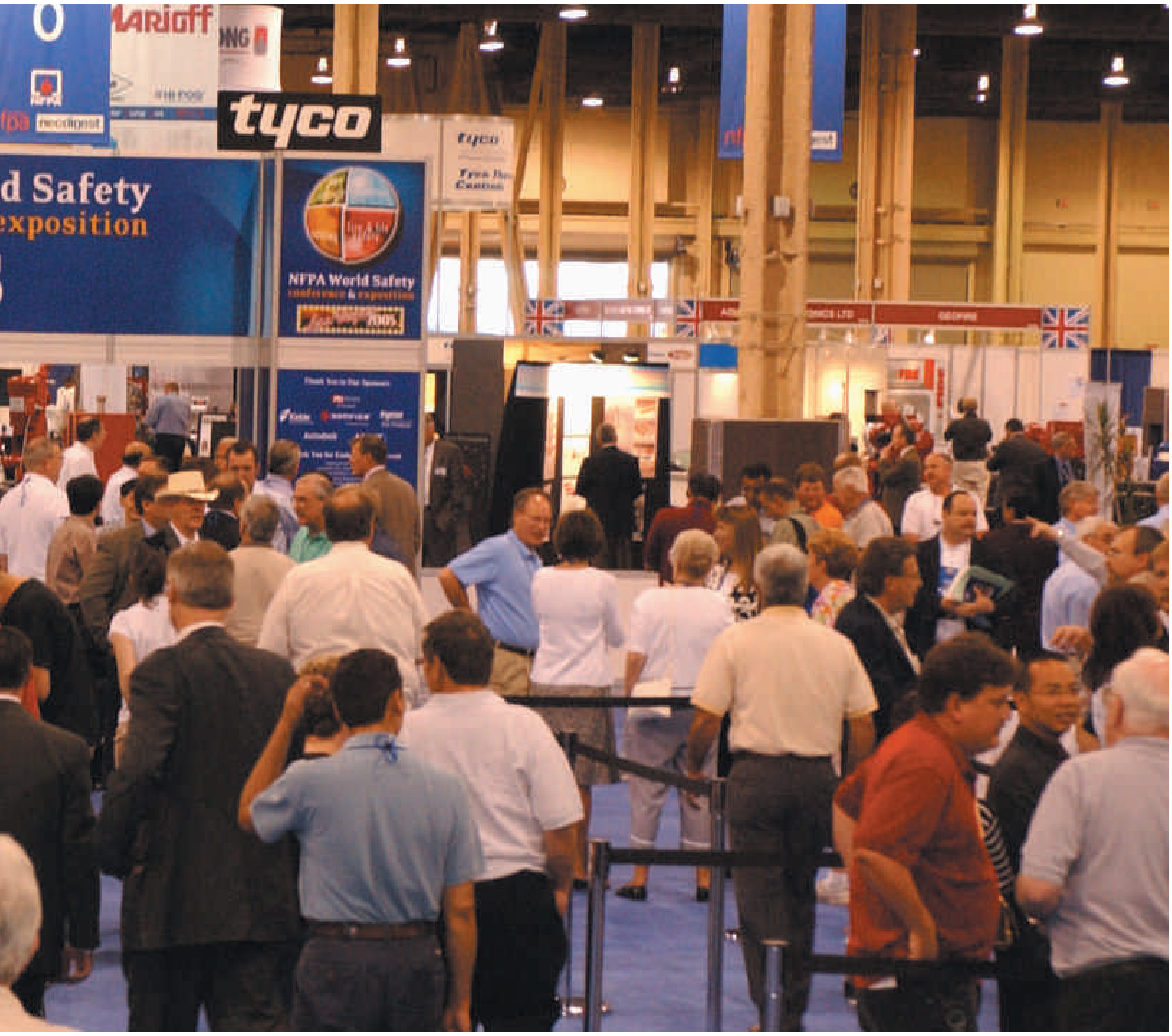
NFPA Preview

An impressive gathering of more than 4,000 fire and life safety professionals will take place June 4-8 at the Orange County Convention Center in Orlando, Florida.

The 2006 NFPA World Safety Conference & Exposition® (WSC&E) with its 137 education sessions and more than 250 exhibitors continues to be the premiere event in the fire protection industry. The powerful educational line up includes experts from such notable organizations as the NFPA, Dow Corning Corp., Chevron, RJA Group, ARUP, Factory Mutual Research, and Starwood Hotels. These experts will bring you stimulating case studies, vital code updates, and information you will be able to readily apply on the job.

Among the many compelling sessions you may choose from is *Significant Investigations Conducted by the Chemical Safety Board* given by Carolyn Merritt of the U.S. Chemical Safety and Hazard Investigation Board. Chairman Merritt's comments will address the impact of explosions on facilities and communities as revealed through a number of significant CSB investigations. The *Toronto Eaton Centre Fire Alarm Retrofit* session is a fascinating case study that will review the issues and solutions used during the retrofit of a fire alarm system in an area comprising almost 150,000 square meters of retail space and four high-rise office towers. Other sessions that may be of particular interest include: *Scottish Historic Buildings-National Fire Database Project, Commissioning of Fire Protection Systems,* and *Challenges In The Design of Mass Notfication Systems.*

The 2006 featured presentation centers on Hurricane Katrina which ravaged the gulf coast of the United States in August of 2005. Katrina's devastation affected an estimated 233,000 square kilometers and displaced 400,000 people. Acting Director R. David Paulison of the Federal Emergency Management Agency (FEMA) will discuss some of the lessons learned from this tragic event and how these lessons may have affected the



response to hurricanes Rita and Wilma that followed. He will also offer his view on FEMA's short-term goals and how this vital organization will continue to lead America to prepare for, prevent, respond to and recover from disasters with its vision of "A Nation Prepared."

Networking is paramount at the WSC&E. No other industry event offers you the same chance to connect with thousands of knowledgeable people, including NFPA engineers, industry scholars, manufacturer representatives, and other dedicated professionals like yourself. This is the perfect opportunity to exchange ideas and information with fellow professionals who share your commitment to fire safety.

The exposition has grown to over 62,000 square feet of exhibit space. This is your best opportunity to meet with over 250 industry-leading companies displaying everything from annunciators to water mist systems. Come talk to the folks that develop the technologies and provide the services you use on a regular basis. The biggest names and the up and comers will all be in Orlando to answer your questions and offer you new solutions to your most pressing challenges.

Detailed conference information and online registration is available on the NFPA website at www.nfpa.org/wsce IFP

Evolution of Fire Alarm Technology:

Interactive Firefighter's Display

Envision a fire department responding to a fire alarm in the middle of the night. The facility is primarily occupied during the day, like an office building, shopping mall or industrial plant. There is no visible smoke. This building – like many others around the world – has no trained security force patrolling it, no bank of CCTV monitors being carefully watched for any sign of trouble. Then an alarm from the fire control panel alerts the local fire department to a potential fire situation.

Peter J. Ebersold and Trista A. Budd

This happens everyday to firefighters around the world. When the firefighters arrive and enter the building, they have many crucial questions:

Where is the emergency?

- Is it an actual fire event and if so, where did it start?
- How long has it been burning and which way is it spreading?
- What's the fastest way to reach people in need of aid?
- Are there any internal structural or chemical hazards?

Revolutionary Firefighter Tool

When firefighters arrive on the scene of a building fire emergency, they first must gather information to accurately assess the situation. Speed of assessment is critical. The more rapidly the origin of the fire and its progression is identified, the more effectively resources can be deployed on the fire scene. Increased speed and accuracy of response result in the potential reduction in loss of property and life.

Using a new interactive wayfinding technology, firefighters receive answers to critical questions quickly and reliably. This revolutionary touch-screen PC for firefighters simplifies emergency scene assessment by pinpointing the origin and migration of a fire. The display is installed in a building lobby or main entrance to a facility. This breakthrough technology gives first responders the ability to access the information they need to perform their jobs safely, effectively and efficiently.

Firefighters now have an additional tool to fight a fire, potentially reducing property loss and improving life safety for building occupants and the firefighters themselves.

The new interactive firefighter's display is housed in a rugged wall mounted box to be installed in a building's lobby or common area. The display is powered by a 24 volt power supply with battery backup. The box is locked during normal conditions and unlocks automatically once the fire alarm system is activated. The touch screen is driven by the fire alarm system. Multiple displays can be installed in any facility. For example, in sprawling industrial complexes, a touch screen display can be positioned at every major facility entrance. The display units operate separately, so unique information can be viewed on different units simultaneously.

Fire Alarm System Evolution

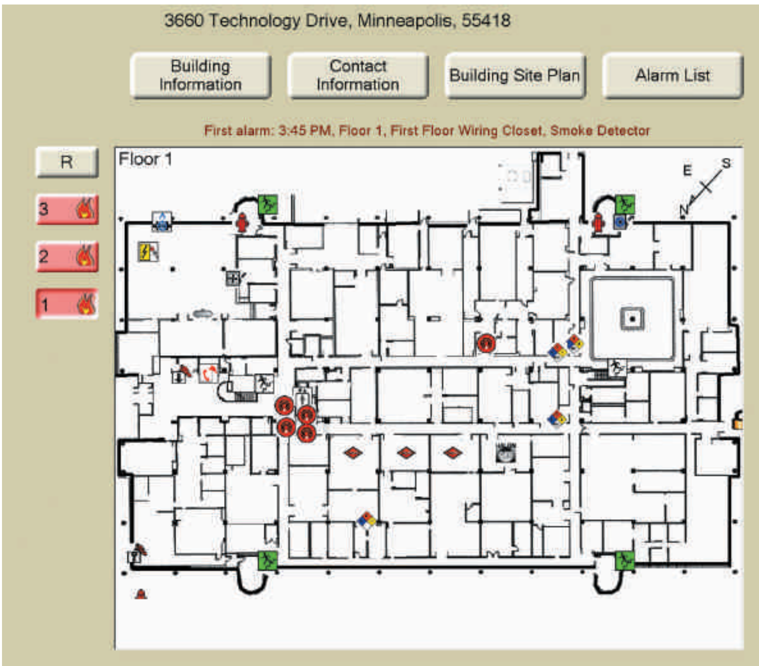
Fire alarm life safety systems have been moving towards more intelligence for quite some time. The dramatic shift in demand from conventional to addressable systems was driven by the need to more accurately identify the origin of a fire alarm. Addressable systems have the ability to pinpoint the origin of an alarm, whether it is an automated fire detection device such as a smoke or heat detector or a manually operated device such as a pull station. Modern addressable fire systems not only have the ability to display a description of the location but also the ability to crudely communicate the spread of the fire. The new interactive firefighters display is the next evolutionary step in intelligent fire systems.

Addressable fire alarm control panels (FACPs) were one of the first steps to assist in pinpointing the origin of a fire. With features such as custom labels, the FACP can display an alphanumeric description of the location of an activated detector(s). This custom label information is most useful to someone who is familiar with the layout of a building such as a facility manager or maintenance personnel. Since many life safety emergencies can occur after normal working hours, building personnel may not always be on site to assist firefighters in locating a fire. The new wayfinding technology gives firefighters timely information on the origin and spread of a fire within a structure whose layout they are not likely to be familiar with.

Today, current fire alarm control panels (FACPs) and annunciation technologies in commercial buildings are a primary source of alarm information for firefighters arriving on the scene. This is particularly true at night when building occupants are not there to report their observations. Current fire alarm control panels and traditional annunciators indicate only the devices that are in alarm. This sensor/detector information is given in a rather austere form. Typically, the fire panels presents activated smoke/heat detectors as items in an alphanumeric list, each activated detector described by an alphanumeric location code, and an activation time.

In order to interpret the data the firefighter must perform two tasks. First, they must translate the alphanumeric location code for each detector in the series to a location in the building. Second,

Facility Type	Why Use Wayfinding Technology?	Examples
Medium to Larger Size Buildings & Complexes	Fighting fires in larger facilities tends to be more complicated with involved building layouts	• large distribution centers • assembly plants
High Value Buildings	Buildings occupied by a large number of people or contain extremely valuable property need fire response personnel immediately directed to the event location.	• hospitals • museums and galleries • high rise office or residential properties • sports arenas • concert halls
High Risk Buildings	When buildings have high risk and/or hazardous materials, wayfinding technology clearly shows the location of these materials on the building layout. By selecting the HazMat icon, the first responder can learn important details about the material and appropriate fire suppression technique.	• petrochemical plants • munitions manufacturing • data storage • archival storage facilities • laboratory facilities (commercial, education, forensic)
High Visibility	Businesses that can gain increased security by including wayfinding technology in the fire and life safety system.	• luxury hospitality • high rise condominiums • shopping malls • premium office space



in order to understand the time sequence in which the detectors were activated and hence, assess the speed of fire propagation, they must read through the times in the alphanumeric detector list and create a mental timeline. To understand both the speed and direction of fire propagation, the firefighter must do both of these simultaneously. In contrast, the firefighter display saves crucial assessment time by providing a spatial, graphical depiction of the location of activated detectors in the building and a graphical visualization of the time sequence of detector activations.

But with this new wayfinding technology, firefighters are no longer limited to fire alarm information only. Now they have the power to see virtually everything within the building that can help or hinder their response. In addition to these two major features, the display also support firefighter situation assessment by providing easy access to graphical, spatial information on the location of water supplies, evacuation routes, access routes and points, fire barriers, gas, power, and HVAC shutoffs, and chemical and structural hazards present in the building.

Designed by Firefighters, For Firefighters

When a firefighter arrives on the scene, the time required for scene size-up must be minimized while the amount of information gathered must be maximized. As a result of thorough research and extensive interviews with senior level professional firefighters, the new interactive display was developed to provide critical answers in 30-60 seconds. The display is so intuitive to use that no special training is required. Firefighters can quickly obtain crucial information about a building emergency that is easy to interpret with a spatial, graphical depiction of the location and sequence of detector activation.

When a firefighter first approaches the display, the default screen graphically identifies where active detectors are located in a structure overlaid on the building floor plan. The active detector icons flash in sequence of activation to clearly indicate fire origin and the direction which it is spreading. By selecting the active detector icon, the firefighter learns the device details and how long it has been active. On the first screen the responder has an overview of the entire building, viewing crucial data such as the number and location of all entrances and exits, offices/ rooms and wall locations. Any hazardous materials in the facility are also immediately apparent with HazMat icons overlaid on the floor plan (above).

Firefighters have a choice of which information to access, based on what type of emergency is occurring and what their experience tells them they need to know quickly. The large display and clearly labeled icons makes it easy for fire fighters to touch the screen and gather critical event information even while wearing thick gloves. Each screen gives maximum information with minimal navigation. In fact the user is never more than one screen away from the information they need.

And finally, all the icons used are industry standard and instantly recognizable to virtually all first response personnel. If the building is part of a new development, or if the first responder is not completely familiar with the area in which the building is located, he or she can access a site plan that shows the building's geographical location and position in relation to surrounding streets, landmarks, or other buildings. And first responders no longer need to search for emergency contact names or other important phone numbers. All this information is displayed on the contact list, which is clearly marked on the interactive touch-screen.

Applications/Typical Installations

Because the interactive display is designed to speed up and clarify the decision making process for firefighters, the more complex the decision making process, the more valuable the system. Therefore, the system is most important to larger buildings and larger complexes/campuses.

One of the first installations of this new technology is in a science building of a university in the United States. The complex layout of the laboratory facility and the numerous hazardous materials used and stored in the laboratories make the interactive display valuable. Some other key applications are outlined in the table opposite.

Conclusion

The new firefighter's interactive display takes the information available to responding fire companies to the next level and increases the value of the fire alarm system in planning an attack on a fire. Ultimately, this new wayfinding technology assists firefighters in what they do best: evacuate the building, locate the seat of the fire and extinguish it to stop further property loss. IFP


www.bbc.be

Fire protection and beyond:

Solutions in Glass

We are all (or should be!) adept at multi-tasking in our daily lives. To succeed in the modern work environment we take on a number of varied roles. This is also true of the materials specified in modern architecture and building design. We demand that our products fulfil more and more functions with greater than ever levels of performance. Glazing solutions are increasingly required to incorporate multiple benefits within a single system.

By Andrea Marston

Glaverbel (UK) Ltd

Fire-resistant glass has played an important part in building design for many years. The earliest form of wired glass was first introduced over 100 years ago and whilst this functional product is still available there have been many technological advances in this field. Nowadays products are available that not only meet the rigorous standards required for fire protection but also offer desirable aesthetic solutions in line with contemporary architectural design. Architects and specifiers appreciate the flexibility of glass with its high levels of light transmission, transparency and neutrality and this trend is reflected by the growing amount of glass used in our buildings.

Sustainability is also a key theme in modern architecture. Rising energy costs mean that building materials need to be as energy efficient as possible. A theme that glass manufacturers such as Glaverbel are responding to. By expanding their product portfolio, Glaverbel are able to offer glass solutions that can be combined to provide not only fire protection but protection to the environment (special glass coatings that help to reduce heat loss and overheating therefore reducing energy costs) and protection against noise pollution as well.

Making the right choice and selecting the most suitable product for the job is of paramount importance especially in the field of fire-resistant glazing where the cost of getting it wrong has potentially devastating consequences. For this reason, it is advisable to seek the advice of the manufacturer or a specialist glazing contractor at the specification stage of a project.

Energy Efficient Solutions – with European governments looking at how to achieve the

energy savings required under the Kyoto agreement much bigger emphasis has been placed on the performance of glazing in terms of thermal and solar protection. The use of double-glazing and glass coatings that insulated against heat loss and excess solar heat transmission can greatly contribute towards reducing the heating and cooling costs as well as helping to maintain a comfortable ambient temperature within a building. The impressive performance of low-emissivity glass has lead to its use being made compulsory in some countries such as the U.K. High performance neutral coatings such as Energy N from Glaverbel can be used within double-glazed units combined with a fire-resistant glass such as Pyrobel to offer a thermally efficient, fire-resistant façade. The neutrality of such products ensures that light levels and views of the world outside are not compromised. It is very important to check with the manufacturer that the proposed glass and glazing system have the appropriate fire certification and have been proven to work.

Acoustic Solutions – nowadays noise is a major source of pollution with ever increasing amounts of road and air traffic. Our towns and cities are vibrant, exciting places to live and work but research shows that prolonged exposure to noise can lead to health issues such as stress and lack of concentration. Since it is often impossible to control external noise sources, it is important to consider a solution to create a noise barrier that reduces transmission of sound. A basic principal to achieve this is to increase the mass of the barrier i.e the thicker the glazing the greater the sound insulation. Some fire-resistant glass products such as Pyrobelite and Pyrobel are laminated glasses, which means that they already have a level of sound insulation (for example Pyrobelite 7 offer a sound reduction of 35 dB RW compared with ordinary 6mm float glass at 31 dB RW). By combining these products in asymmetric double-glazing you can greatly reduce unwelcome noise intrusion. Specially designed acoustic laminated glasses such as Stratophone (a laminated glass containing a special film) work to dampen noise by absorbing sound. As with the energy efficient solutions, the manufacturer's advice should be sought in order to ensure that the proposed glazing and framing system are appropriate.

Design Inspired Solutions – whilst clear, neutral glazing is highly popular in 21st century design, there are occasions when the architect or specifier will look for a different type of finish, be it an opaque glass for reasons of privacy or even a textured glass to add an extra dimension to the glazing. It is now possible to source fire-resistant glass with a satin-like frosted, translucent finish or even a decorative pattern figured onto the glass surface. The possibilities are out there

All of the above criteria were considerations for the project team working on the complete refurbishment of the Casino at Ooestende in Belgium where some 600m^2 of fire-resistant glazing was recently installed. Large glazed areas to the concert hall meant that a glazing solution offering fire protection of 60 minutes integrity and insulation and a sound reduction of 50 dB was needed. Glaverbel were able to supply a solution using double-glazing incorporating Pyrobel 25 (60 minutes integrity and insulation), a 32mm cavity and 12.8 Stratophone (acoustic laminated glass). Other internal partitions where sound control was not an influencing factor were single glazed with 60 minutes glass and hardwood framing and with sandblasted glazing for some internal doors for added privacy. Although fire-resistant glazing was not required for the façade itself, double-glazing with a high level of thermal insulation was used.

In summary, the latest product offerings in glass mean that designs we never thought possible can now be achieved. Twenty years ago a glass that could not only protect you from the danger of fire, but also offer the ability to save you money on your heating bills was something architects and construction engineers could only dream of. Thanks to the investment in research and development by companies like Glaverbel, those dreams are now a reality. Be it flexibility, sustainability or impressive modernity in design, glass can make it all possible.

Who knows what the future might bring? A glass that brings you breakfast in bed would certainly top our list! IFP

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Architecture today demands fire glass solutions that fulfil both the high demands of design and multifunctional usage, which has been achieved by the Vetrotech Saint-Gobain products. They can easily be combined with all Saint-Gobain products, from ornamental glass like Masterglass etched and printed glass, to floor applications.
In combination with the Saint-Gobain Glass Comfort, Design, Vision, System and Protect product families, they open up new creative possibilities as well as high levels of safety.

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SAINT-GOBAIN GLASS

- Close to you in your everyday life -

View of fire pump showing motor, pump, water supply and pump bypass

Your Fire Pump is Your Friend

Do you realize that your fire pump is the heart of your fire sprinkler and standpipe systems? These systems are designed within parameters that utilize specific gallons of water per minute at a precise pressure. Your fire pump is the source for that water, taking its' supply from the municipal water distribution network or on-site stored water, supplying the volume and boosting the pressure to the level required for your fire suppression systems to operate properly. The proper operation of the fire pump is vital for the protection of your facility, for without it, none of the automatic systems would operate in the manner in which they were designed.

By Terence Manning

Rolf Jensen & Associates, Phoenix, Arizona

Do you realize that your fire pump is the heart of your fire sprinkler and standpipe systems? These systems are designed within parameters that utilize specific gallons of water per minute at a precise pressure. Your fire pump is the source for that water, taking its' supply from the municipal water distribution network or on-site stored water, supplying the volume and boosting the pressure to the level required for your fire suppression systems to operate properly. The proper operation of the fire pump is vital for the protection of your facility, for without it, none of the automatic systems would operate in the manner in which they were designed.

The standards that guide the proper installation of a fire pump are the National Fire Prevention Standard for the Installation of Stationary Fire Pumps, NFPA Pamphlet 20, The National Electrical Code (NEC), NFPA Pamphlet 70, Article 695 and The Standard for the Inspection, Testing and Maintenance of Water Based Fire Protection Systems, NFPA Pamphlet 25. These documents provide direction for selection and installation of fire pumps, their controllers, electrical power supply and periodic maintenance. Most Model Codes reference these documents as the definitive source for fire pump installations.

Because the fire pump is such a vital piece of your fire protection, the room that the pump occupies must be protected by fire rated construction of two hours or one hour if protected by automatic sprinklers. The pump may also be installed outdoors if the climate permits but it must be at least 50 feet from any exposing building. For the same reason, the power supply for an electric fire pump must be sized to carry the locked rotor current of the pump indefinitely and installed so as to be construed as exterior to the building. Should the conductors be routed through the building, they must be encased in 2

Fire pump controller with transfer switch. Note the chart pressure recorder and brass pressure sensing lines

inches of concrete or within an enclosed construction dedicated to the fire pump circuit having a minimum of a 1-hour fire resistive rating. If the conductors are installed overhead, the structure from which they are suspended must have an equal fire resistive rating. The idea presented by these rules is that the fire pump should run to destruction before shutting down for any reason short of total mechanical failure of the unit.

The most common fire pump is the electric driven centrifugal pump. While this type of pump requires little maintenance, it cannot just sit in a pump room and be forgotten. Like all good friends, it will be there for you when you need it most, but only if you do your share of the friendship. NFPA 25 requires periodic maintenance and testing of the entire pump assembly so that it is ready to go from a dormant state to full operation at a moments notice. The testing and maintenance should be performed by an experienced and reputable fire pump company that has experience with your type of pump and ready access to repair parts. NFPA 25 requires an annual test of all components of the pump system. The pump shall be tested on an annual basis but you should make a monthly visit to your pump room to observe general conditions and make sure that the pump packing is allowing slight dripping. These drips signify that the packing is not too tight and will allow for the proper lubrication and cooling of the bearings.

Look at the fire pump controller and make sure that the circuit breaker is in the on position and the door is closed and securely latched. Check the temperature in the room and ensure that the room is not being used for any storage.

The diesel driven fire pump is the second most popular type of pump. While the pump itself is the same as the electrically driven pump, the diesel engine requires significantly more attention. The diesel engine controller has a weekly test feature that automatically starts the unit and exercises the engine for a period of no less than 30 minutes. NFPA 25 requires that qualified personnel are present for the weekly test. It is important to have a witness to the weekly diesel test to observe the smoothness of the running engine, engine gauges, engine cooling, pump temperature, fuel level and general operation. The requirement for a yearly test by a qualified pump company is most important because, in addition to the mechanical test of the pump, the diesel engine also needs testing and calibration checks. The pump room should be inspected the same as for the electric pump room.

The fire pump will have an automatic relief valve that is set below the shutoff pressure at the minimum expected suction pressure. This automatic valve allows water to be discharged from the pump during low flow and no flow conditions and helps to dissipate heat that may build up in the pump during these conditions. The valve shall discharge into an open pipe or cone and readily visible to the pump operator. If the discharge is into a closed pipe, a means to detect flow, such as a sight glass, is required. The valve should be .75 inches for pumps up to 2500 gpm and 1 inch for larger pumps. In the case of a diesel pump where the water supply for the engine heat exchanger is taken from the pump discharge, the use of an automatic relief valve is not required as the cooling water is also discharged to a drain.

If your suction water supply pressure is of sufficient pressure to be of material value without the pump (i.e.: for lower floors), a pump bypass will be installed around the pump and sized the same as the pump discharge piping. This bypass will have an OS&Y valve and a check valve to prevent water recirculation. Check to make sure that the bypass valve is in the open position. In fact, check to make sure that all valves in the pump room are fully open with the exception of the pump test valve which must be fully closed in normal operation. A low suction throttling valve may be present if your authority having jurisdiction requires positive pressure to be maintained on the suction side of the pump. If you have such a device it will be located between the pump and the discharge check valve.


In Case of
FIRE
~~BREAK GLASS~~
RELAX

Side view of fire pump showing pump, pump bypass and test header pipe. Note the positions of the discharge check valve and bypass check valve

These devices are not common in most areas so don't feel like you are missing something.

Because the automatic starting of a fire pump except for test purposes should be avoided, pump installations include a pressure maintenance or jockey pump. This pump is a low gpm pump with the same discharge pressure as the fire pump and its pressure is set at the pump churn pressure plus the minimum static supply pressure. The start point should be at least 10 psi lower than the jockey pump stop point. The main pump start point should be 5 psi lower than the jockey pump start point. (See NFPA 20 Section A14.2.7 #4 for more details) These pressure differentials are important to maintain. If the main pump start point is significantly lower than the jockey pump start point, the excessive pressure differential may cause mechanical problems in your sprinkler systems.

The type of electric fire pump controller is usually selected based on the horsepower of the motor that is required to drive your pump and the capacity of your electrical power supplies. Typically, motors up to 75 horsepower have an Across the Line controller. This style of controller allows the motor to start directly. The starting current will not affect other loads on the supply transformer and it is the least expensive. If your fire pump is 100horsepower or greater, the application of a reduced voltage controller is advised to soften the current inrush to the motor so the normal electrical loads are not affected. This type of controller is also used for those applications that have a generator as an alternate source of power. There are several different techniques used for reduced voltage starting. Some of these techniques are Primary Resistance, Wye/Delta and Soft Start motor controllers. The easiest controller on both the electrical and mechanical systems is the soft start controller. This device is a very sophisticated variable speed style controller which starts the pump at a slower speed and slowly ramps up to full speed and full pump output. If you have older fire protection systems or a lot of underground pipe and you need to replace your fire pump controller, you should seriously consider a soft start unit which will reduce the mechanical stresses to your piping systems when the fire pump starts.

The electric fire pump controller is UL listed as "Suitable for Use as Service Equipment" (SUSA), listed for fire pump use and has a minimum NEMA rating of NEMA type 2, dripproof. This means that any conduits that enter the top of the controller must be connected with a sealing fitting such as a "Meyers Hub" in order to maintain the NEMA rating. Ordinary lock nuts are not acceptable as water may enter the controller, cause a short circuit, and knock the pump out of service when you need it most. The controller has three methods of starting. The normal starting of the fire pump is accomplished through the pressure switch inside of the controller and connected to the discharge side of the fire pump by a non-ferrous sensing line. The second method utilizes start/stop switches on the front of the unit. The third way is the emergency run handle. This handle is located on the outside of the controller and it mechanically pushes the motor contactor in so that the motor can be operated even if the control circuits are inoperable. If the power feed to the controller has an alternate supply from a generator, the transfer switch, which is also UL listed for fire pump service is usually in integral part of the controller. The use of transfer switches that are not UL listed for fire pumps is not allowed. Electric controllers are equipped with supervisory alarms that must be monitored at a constantly attended location. These alarms are pump running, phase failure and phase reversal. If the controller also has a transfer switch, a transfer switch operated signal is also required. Your facility's fire alarm system is a viable point of connection for these alarms if it is monitored by a central station alarm company.

Diesel driven fire pumps are much more complex than their electric cousins. The diesel engines that are applied to fire pump installations are UL listed for fire pump use and have some very unusual

components that are not common to most diesel engines. These engines have a governor that regulates the speed of the pump to a range of 10% between shutoff and maximum load conditions. An engine overspeed shutdown device is also included to shut the engine down if the speed reaches about 20% over the rated speed. If this device activates, it must be manually reset. Another unusual item on a fire pump engine is the dual starting feature. There are two starter contactors and two sets of batteries that alternate operation and if one fails, the other contactor operates to start the engine. To help the engine to turn over quickly, the engine cooling jacket has a thermostatically operated heater that keeps the engine warm so there is no need for a warm-up period that would adversely affect the power output of the engine.

The diesel fire pump controller, like the electric controller, is a NEMA type 2 dripproof enclosure and the same conduit entry rules apply. The controller has two separate battery chargers and the ability to manually start the engine from either contactor. The integral alarms for a diesel include switch in off position, high engine temperature, failure to start, overspeed, battery failure and low fuel level (tank level below two-thirds). The remote alarms are pump running, main switch in off position and pump trouble. The controller has a pressure recorder that is spring wound or motor driven with a chart that must be replaced on a weekly basis. You should mark the date on each chart and keep them in your records.

NFPA 20, Annex B is a quick reference that can help you in ascertaining some common troubles associated with fire pumps. Some of the most common problems should be easy to find if you know what to look for.

A pump discharge pressure that is too high or too low may be due to a change in the city water supply pressure. The pump was designed to include the city pressure in the calculation of the discharge pressure. If the city has changed the supply pressure it will definitely affect your discharge pressure and may lead to damage of the sprinkler piping.

Corrosion or patina coating on relay contacts in the electric controller due to excessive moisture in the pump room can lead to a failure to start the motor automatically.

Pump packing that has been adjusted too tight to allow dripping from the pump shaft can lead to bearing failures.

Pump relief valves that are improperly set can lead to excessive heat buildup in the pump casing during low flow or no flow conditions.

If for some reason the main circuit breaker has tripped, it should be tested and recalibrated by an authorized service company.

Check the temperature of the diesel engine jacket periodically to make sure the thermostat is functioning properly. If the thermostat should stick, it can lead to hardening of the flexible connection hoses which could crack, leak out the jacket coolant and cause the engine to seize resulting in a very expensive repair.

The diesel fuel storage tank has a 5% sump level in the tank. The drain should be slightly opened periodically to remove any water or foreign material that may be present.

The incoming voltage for the electric fire pump should be tested occasionally, especially in the summer months. Public utilities occasionally reduce the voltages that they supply in order to meet the demands that may exceed their capacity. This is called a "brown out". If the voltage is reduced 10% or more, it can reduce the pump discharge significantly.

This article is not intended to be a definitive instruction on fire pumps. There are many things that are not addressed here that have a bearing on proper fire pump installation and maintenance. The reader should refer to the NFPA documents referenced for further information specific to your particular situation. Another good source of information is your professional fire pump company representative. IFP

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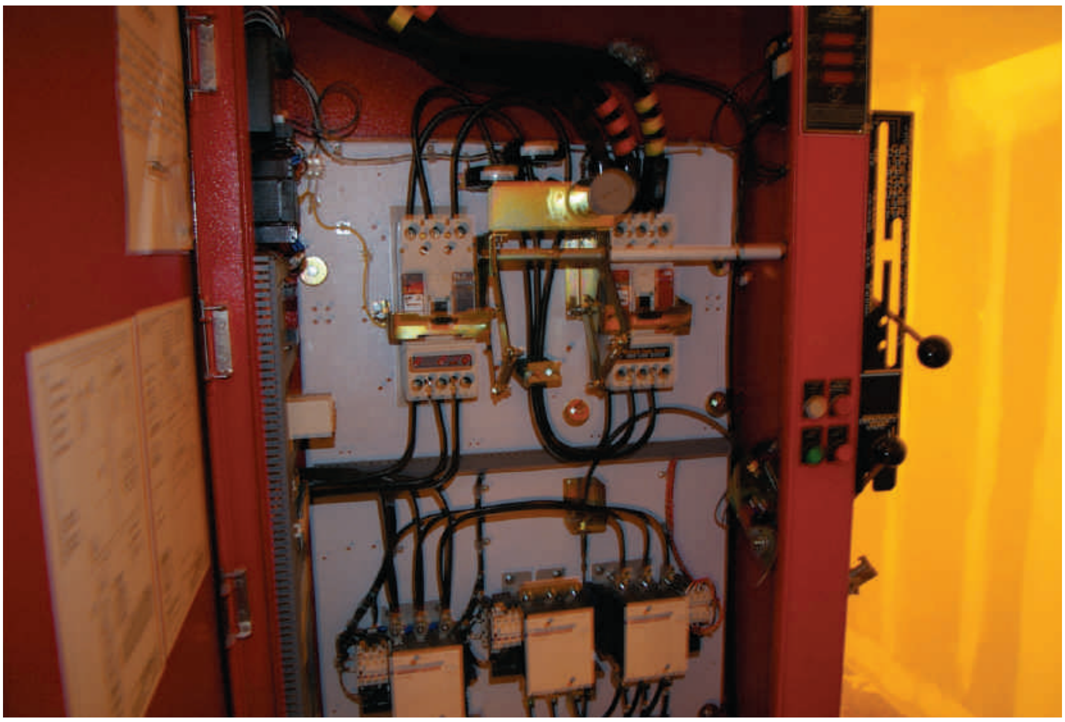


Interior of the reduced voltage controller. The main circuit breaker and disconnect are at the top with the reduced voltage control devices at the bottom

Tunnel safety in Europe

Transport plays a crucial role in supporting European integration and ensuring a high level of well being among Europe's citizens. Hence, efficient infrastructure for transport is vital for EU competitiveness to keep costs down and to provide good service. Moreover, European integration requires sufficient access to EU transport networks for all regions. Therefore, the European Union must aim to promote the development and the well-functioning of Trans-European Networks as a key element for the creation of the internal market and the reinforcement of economic and social cohesion.[2]

By Dimitrios Theologitis

Head of Unit

and

Peter Schmitz

Seconded National Expert, European Commission, Road Safety Unit[1]

Tunnels play an important role within the transport infrastructure network. They facilitate communication between large areas of the Union and are thus essential to long distance transport. They also play a decisive role in the functioning and development of regional economies.

Risks have increased in recent years with the ageing of tunnels and changing traffic patterns. Most tunnels have indeed been built according to specifications that have meanwhile been outdated. Either their equipment no longer corresponds to the state of the art or traffic conditions have significantly changed since their initial opening. Recent tunnel accidents have shown that further to the human tragedy linked to these accidents, a tunnel closed for the usually long reconstruction work causes substantial social costs.

The problem of tunnel safety

In its White Paper on transport policy,[3] the Commission emphasised the need to consider a European Directive on the harmonisation of minimum safety standards to guarantee a high level of safety for the users of tunnels, particularly those in the Trans-European Transport Network.

Because of the confined environment, accidents in tunnels, and particularly fires, can have dramatic consequences. The fires in the Mont Blanc and Tauern tunnels in 1999 and in the Gotthard tunnel in 2001 – and most recently in the Fréjus tunnel – have put the risks in tunnels in the spotlight again and called for decisions at political level. In addition, the potential disruption of the transport system following a major fire amplifies these consequences and can cause severe disturbances in the economy of a whole region. The European Council on several occasions and notably on 14 and 15 December 2001 in Laeken underlined the urgency to take measures at European level in order to improve tunnel safety.[4]

The number of accidents in tunnels is relatively limited. However, fires are fairly frequent although, according to international statistics,[5] the majority of vehicle fires are not caused by accidents, but by self-ignition of the vehicle or its load due to defects in electrical systems or overheated engines. On the other hand, fires with the most serious consequences (fires involving injuries, fatalities or extensive material damage) have mostly been the result of accidents (12 out of the 14 worst fires known world-wide), with the exception of the Mont Blanc tunnel fire, which was caused by self-ignition of a heavy goods vehicle.[6]

Insufficient co-ordination has been identified as a contributing factor to accidents in trans-border tunnels. Moreover, recent serious accidents show that non-native users are at greater risk of becoming a victim in an accident, due to the lack of harmonisation of safety information, communication and equipment.

Different approaches in the past

In new and renovated road tunnels, structural and technical safety installations usually comply with national and international recommendations, requirements or standards. These safety installations can only be fully effective if they are well operated and combined with an efficient emergency service and correct behaviour on the part of road users. Traffic control and monitoring by the police or other authorities can have a preventive effect. However, the constant and intensive efforts of road construction authorities and traffic police cannot fully eliminate the occurrence of accidents and fires in tunnels.

At international level, the Road Tunnels Committee of the World Road Association (PIARC) has produced a number of recommendations, including a report on fire and smoke control[7]. Since 1995, PIARC has been conducting a joint project with the Organisation for Economic Co-operation and Development (OECD) on the transport of dangerous goods through road tunnels, with the support of the European Commission.

In September 1999, the then Conference of Western European Road Directors (WERD) officially requested Switzerland, France, Austria and Italy to create an informal group (the so-called Alpine Countries group) to evaluate a common approach to this problem. On 14 September 2000, WERD approved the measures for increasing tunnel safety proposed by the Alpine Countries group.

The French Government immediately launched a safety check of all road tunnels longer than 1 km. Within three months, a national evaluation committee examined 40 tunnels. One year later, in August 2000, a new requirement on road tunnels

Acronym	Title	Duration	Costs	EU-funding
			Mill Euro	Mill Euro
DARTS	Durable and Reliable Tunnel Structures	03/2001 until 02/2004	3.31	1.66
UPTUN	Cost-effective,Sustainable and Innovative Upgrading Methods for Fire Safety in Existing Tunnels	09/2002 until 08/2006	11.93	6.60
SAFE TUNNEL	Innovative systems and frameworks for enhancing of traffic safety in road tunnels	09/2001 until 08/2004	4.94	2.22
SIRTAKI	Safety Improvement in Road&Rail tunnels using advanced ICT and knowledge Intensive dss	09/2001 until 08/2004	3.0	1.45
VIRTUAL FIRES	Virtual Real Time Emergency Simulator	11/2001 until 04/2004	1.79	1.51
FIT	Thematic Network on Fire in Tunnels	03/2001 until 02/2005	1.47	1.47
Safe-T	Thematic Network on Safety in Tunnels on development of European guidelines for upgrading tunnelsafety	05/2003 until 04/2006	1.0	1.0
EuroTAP	Road Tunnel Assesment Programme	1/01/2005 until 31/12/2007	3.94	1.5
		Sum	**31.38**	**17.41**

Recently finalised and ongoing tunnel safety research funded by the European Commission

safety was approved.[8] Similar steps were taken in Germany[9] and in Austria.

An ad-hoc group on tunnel safety of the Economic Commission of the United-Nations (UN-ECE) published recommendations in December 2001.[10]

The European Commission also included safety in tunnels in its 5th framework research programme. Research projects on durable and reliable tunnel structures (DARTS), the development of decision-support expert system for crisis management in tunnels (SIRTAKI), methods to upgrade existing tunnels with regard to fires (UPTUN) as well as thematic networks on Fires in Tunnels (FIT and SAFE-T) have been funded. Other proposals, relating notably to prevention and information techniques on vehicles or in tunnels are on course.

In Switzerland, the Federal Roads Authority (FEDRO) set up a task force group in April 1999. The task force studied an extensive range of aspects concerning safety in all tunnels over 600 m in the Swiss highway network. Some short-term measures to increase safety were immediately implemented while others will be put into effect over time.[11]

The road tunnel safety directive

As a result of the tragic tunnel accidents in 1999 to 2001, in December 2002 the Commission submitted a proposal for a Directive aimed at ensuring a minimum level of safety in road tunnels on the trans-European network. This proposal of a directive was adopted by the European Parliament and the Council in April 2004.[12] Its requirements apply to tunnels longer than 500 m in the Trans-European Road Network.[13] A total of 515 TEN road tunnels of more than 500 m length were identified, around 50% of which are located in Italy. The total length of these tunnels is over 800 km. The directive sets minimum requirements with regard to both organisation of tunnel safety and technical equipment of tunnels:

Organisational requirements

Considering that the diversity and complexity of organisations involved in managing, operating, maintaining, repairing and upgrading tunnels increases the risk of accidents, the directive establishes of the organisational functions of safety at national level and clarifies the different roles and responsibilities. Therefore it foresees that each Member State appoint an Administrative Authority which is the competent authority responsible for all safety related aspects of a tunnel, assisted by an Inspection Body for commissioning visits and periodical technical inspections. In most cases, Member States will have the possibility of appointing existing administrative services as Administrative Authorities for the purposes of the Directive. Responsibility for safety in each tunnel will lie with the Tunnel Manager and the responsibility for control with the appointed Safety Officer.

Technical requirements

The technical requirements are based on works done in international bodies i.e. the tunnel committee of the world road association (PIARC) and the ad hoc group on tunnel safety of the Economic Commission of the United-Nations (UN-ECE).

Infrastructure

Based on a classification system according to length and traffic volume, the main requirements for infrastructure encompass all structural components, ventilation and other electromechanical equipment. In addition, the directive contains a description of, and requirements for, the positioning of obligatory road signs, panels and pictograms relating to safety. Twin-tube tunnels offer much higher safety potential in the event of a fire.

The Commission proposes thus that single-tube tunnels should only be built if a long-term forecast shows that traffic will remain at a reasonable level (lower than 10.000 vehicles per lane and per day).

Operation

The main responsibilities for the Tunnel Manager are to secure safety for users and operators, to monitor the efficient performance of all installations, to properly maintain all structural and electromechanical installations. In the event of an incident, the Tunnel Manager has to work closely together with the emergency services. Emergency services must at least be consulted when defining operation of the tunnel in emergency cases and emergency response plans. Furthermore, there shall be regular emergency exercises.

Vehicles

Having in mind that vehicle construction standards are defined in another framework (i.e. the European type-approval procedure) all heavy goods vehicles, buses and coaches entering tunnels should be equipped with a fire extinguisher. It is also proposed that any additional tanks mounted on heavy-duty vehicles must be empty when passing through tunnels.

Road users

In-depth analyses of incidents on roads show that an accident is the consequence of one or more faults in a complex system involving drivers, vehicles, the road and its surroundings. Thus, efforts to increase the level of road safety have to aim primarily at preventing human error. The second step will have to ensure that errors made by drivers do not have serious consequences. This directive calls for better information for road users on tunnel safety, e.g. through information campaigns at national level and improved communication between the Tunnel Manager and road users inside a tunnel.

Railway tunnels

Railway tunnels also raise safety problems. Moreover, the construction of very long railway tunnels is planned in the EU for the coming decades, e.g. the Lyon-Turin base tunnel (52 km) and the Brenner base tunnel (55 km). Safety requirements for railway tunnels will be addressed in technical specifications, to be adopted in the context of the railway interoperability directives. The production of the Safety in Railway Tunnels TSI (technical specification for interoperability) has been requested by the European Commission under a mandate delivered on 30th Sept 2002 to the AEIF (European Association for Rail Interoperablity). A draft TSI is now available and has been submitted to the consultation of social partners and users' organisations in accordance with article 6 of directive 2001/16/EC.[14] The aim of the TSI is to specify the measures that are necessary for harmonising safety levels for new and upgraded tunnels on the TEN. The TSI is applicable to all tunnels (new, upgraded, renewed and re-opened) ranging from 1 km to 20 km in length. Tunnels with a length over 20 km require a special safety assessment.

For the purpose of producing the TSI, a group of experts in the field of railway safety has been assembled. In developing the TSI particular, attention has been paid to the work of the UIC railway safety in tunnels working group and UNECE. Both

groups have produced recommendations for safety measures.[15]

In any case it should be emphasised that in particular for very long tunnels there is a preference for rail over road not only from an ecological but also from a safety point of view. It is generally considered that, especially if the share of goods transport is high, rail is the more appropriate mode of transport.

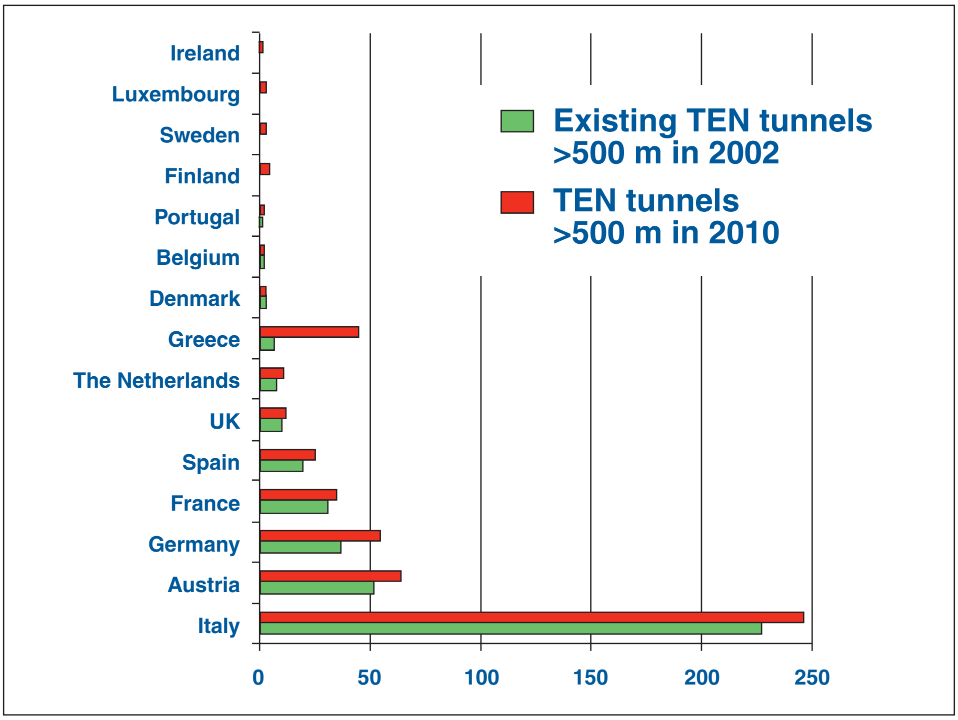
Costs

Costs play a key role in improving tunnel safety, both of road and of rail tunnels. Improvement costs include three components: refurbishment and equipment, operational costs, and costs of traffic delay caused by the refurbishment. Costs for refurbishing road tunnels in accordance with the full set of requirements of the directive can be very high, because tunnels are the most expensive pieces of road infrastructure. For this reason, the Directive allows Member States to implement less costly measures under certain conditions where they achieve a sufficient safety level. For this purpose, a system differentiates requirements according to traffic volumes and length, and Member States are allowed to accept alternative risk reduction measures when refurbishment costs are excessive. However, these results clearly demonstrate the need to prioritise tunnel safety investments, starting with the tunnels with the highest traffic volume and the greatest risk of accidents.

The total cost for the implementation of the directive is in the range of 2.6 to 6.3 billion Euros. The latter figure assumes that all existing tunnels will be adapted to meet the provisions of new tunnels. The lower figure is an estimate where certain modifications in tunnel structure are replaced by alternative or substituting measures, such as operational measures or even traffic restrictions, which might also be able to avoid the closure of the tunnel in case of structural modifications. Substantial reductions of costs for refurbishment can also be yielded if necessary works are linked to major maintenance works. By carefully timing these works it may well be possible to upgrade the safety level of an existing tunnel at marginal costs by only replacing tunnel equipment such as ventilation systems or lighting by more appropriate systems when their normal lifespan is over.

Refurbishment and equipment account for the majority of costs, though traffic delay is estimated to account for one quarter of the costs. The costs incurred by the Directive will be borne by the Member States. The necessary refurbishment of existing tunnels shall be carried out according to a schedule and shall be finished April 2014. This period may be extended by 5 years for Member States whose total tube length of existing tunnels divided by the total length of the part of the Trans-European Road Network located on their territory exceeds the European average. Member States have to submit refurbishment plans to the European Commission by April 2007.[16]

Direct costs of tunnel accidents have been evaluated on the basis of a review of the recent literature and the collection of limited data on recent accidents. They are estimated at 210 million Euros



Number of tunnels per Member State (EU-15) covered by the tunnel directive in 2002 and 2010

per year. Indirect costs on the economy resulting from the closure of a tunnel should also be taken into account. Following the Mont Blanc accident and its subsequent closure, studies calculated these costs to be within a range of 300 to 450 million Euros per year for Italy alone.[17] Significant potential indirect benefits of this Directive should also be considered. Tunnel closure as a consequence of an accident is prejudicial not only to the regional economy but also to the national and in some cases even to the whole European economy. It increases transport costs, reduces the competitiveness of the areas affected by the closure and has an adverse effect on road safety, as it tends to lengthen journeys, thus increasing risk exposure for all road users for a potentially long period.

Conclusions

The recent tunnel fires have raised the question of the sustainability of transport, particularly in mountainous areas. In this respect, a coherent approach to developing medium and long-term solutions, including a shift in transport modes, is one of the priorities set out in the White Paper on Transport Policy. The measures of the road tunnel safety directive will largely help to reduce the risk of accidents in tunnels. It is strongly recommended to the Member States to apply these standards also to other road tunnels that are not part of the trans-European network. Similar initiatives for the safety of rail tunnels are currently under consideration.

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IFP

Corporate Manslaughter

Looks like Government has ducked the issue!

ASFP
ASSOCIATION FOR SPECIALIST FIRE PROTECTION

Under the proposed Regulatory Reform (Fire Safety) Order (RRO), the onus for fire safety in existing buildings will shift even more onto the 'Responsible Person' for the building to carry out risk assessments and to act upon their findings to maintain and repair the installed fire protection systems in the building.

By Graham Ellicott

Chief Executive, Association for Specialist Fire Protection (ASFP)

For the purposes of the RRO the Responsible Person is:

- The employer (where there is one)
- The person in control of the premises in connection with the carrying on of a trade, business or other undertaking (for profit or not)
- The owner
- Any other person who to any extent exercises control over the place.

To satisfy the requirements of the RRO the responsible person will be required to ensure that an assessment of the risk of, and from, fire is undertaken for the place and activity. Identified hazards will be removed or reduced so far as is reasonable and special consideration will be given to the risks posed by the presence of dangerous chemicals or substances and the risks that these pose in case of fire. Special consideration will also be given to any group of persons who may be especially at risk in case of fire, whether due to their location or any other factor. All precautions provided will be subject to maintenance and will be installed and maintained by a "competent person".

Under the RRO a person is to be regarded as competent where he/she has sufficient training and experience or knowledge and other qualities to enable him/her properly to assist in undertaking the preventive and protective measures. For commercial buildings the main enforcing body will be the local fire and rescue authority.

Identified hazards will be removed or reduced so far as is reasonable and special consideration will be given to the risks posed by the presence of dangerous chemicals or substances and the risks that these pose in case of fire.

Fine words, but how do we concentrate the

attention of the Responsible Person on carrying out his or her duties, which involve ensuring the safety of all, in or around his or her building? Well, in the past the Association for Specialist Fire Protection (ASFP) has called for the Government to get off the fence with regard to Corporate Manslaughter and it has now finally laid out proposals for reform of the law and intends to introduce a new bill.

Parliamentary time, however, has still not been allocated for the legislation. But is this a step forward?

Under the 'old' regime, five rail executives from Balfour Beatty were charged with breaking safety rules over the Hatfield crash disaster in which four people died and more than 100 were injured in October 2000. In early September 2005 it took an Old Bailey jury of eleven men and one woman, fifteen hours of deliberation (over four days) to reach not guilty verdicts. Network Rail, however, was convicted of safety breaches. Balfour Beatty, the company responsible for track maintenance, had already pleaded guilty to breaking safety regulations.

Special consideration will also be given to any group of persons who may be especially at risk in case of fire, whether due to their location or any other factor. All precautions provided will be subject to maintenance and will be installed and maintained by a "competent person".

In early October 2005, Balfour Beatty was fined £10m and Network Rail £3.5m for breaking safety rules before the crash. In addition, the companies were ordered to pay £300,000 each in legal costs. The judge, Mr Justice Mackay, described Balfour Beatty's breaches of the Health and Safety Act as "one of the worst examples of sustained industrial negligence".

Balfour Beatty and the five executives were originally charged with manslaughter, but these charges were thrown out by the judge earlier in the seven-month trial. Network Rail had originally been charged with manslaughter but these charges were dropped before the trial began.

Testimony during the trial was given to the jury indicating that Hatfield was a "disaster waiting to happen".

Indeed, the prosecuting counsel alleged there had been a catalogue of safety breaches before the disaster, which amounted to a "cavalier approach to the safety of those in trains".

Following the announcement of the fines, Carol Bell of the Safe Trains Action Group commented "We have said that there have to be bigger, swingeing fines for companies and it's good to see that there have been in this case." However, Ms Bell – who was injured in the 1997 Southall train crash, added that she was disappointed that prosecutions for manslaughter and corporate manslaughter had failed in this case and in other previous cases. "It is terrible that people can be in charge of companies involved in these crashes and get away with it" she said.

Following the announcement of the fines, Carol Bell of the Safe Trains Action Group commented "We have said that there have to be bigger, swingeing fines for companies and it's good to see that there have been in this case."

"If they knew they could go to jail, maybe they would take safety more seriously. I would support any change in the corporate manslaughter laws. There has been plenty of talk about changing them, but nothing seems to be happening."

In my opinion, the comment *"If they knew they could go to jail, maybe they would take safety more seriously*", coming from a victim of a disaster, sums up the situation succinctly.

A past Chief & Assistant Chief Fire Officers Association (CACFOA) survey has highlighted the ignorance of building owners with regard to fire risk assessments and the question must be asked will this ignorance suddenly disappear under the RRO? I believe the answer to this question is NO. But if a main board director of a major company felt that there was a possibility of him or her spending time at 'Her majesty's Pleasure', then we have a far better chance of getting a YES to the question!

"If they knew they could go to jail, maybe they would take safety more seriously. I would support any change in the corporate manslaughter laws. There has been plenty of talk about changing them, but nothing seems to be happening."

But under the new proposed corporate manslaughter law would the situation have been any different? The likelihood is also NO as it seems that the Government has watered down the provisions, which mean that individuals won't be involved and thus there will be no jail sentences.

I just hope that after a major fire I won't be hearing a senior Fire and Rescue Officer say in court "this was a disaster waiting to happen". IFP

Fire rated non-loadbearing partitions

– an overview . . .

By The Association for Specialist Fire Protection (ASFP)

Lightweight, non-loadbearing partitions, are used in all types of buildings; the actual form of construction will be determined by the specified performance criteria and desired appearance.

Fixed stud and sheet, or panel partitions, are normally used in housing, schools and industrial buildings, whereas re-locatable frame and sheet systems are more appropriate for offices and other commercial buildings. Twin-framed constructions of various types are also available, which are used to sub-divide multi-screen cinema complexes and other applications requiring high sound insulation.

To some extent all partitions help to contain the effects of fire and depending upon the size and function of a building, national Building Regulations require lightweight, non-loadbearing partitions, to have specific fire resistance. When correctly specified and installed the partitions will contribute substantially to the safety of the occupants of the building. Insurance companies may also specify particular requirements for certain applications such as property protection.

Accordingly, many partition suppliers carry out extensive research and development and are able to demonstrate that their partition designs can achieve satisfactory levels of fire resistance when tested in the laboratory to the appropriate standards.

A partition is defined in British Standards as an "internal, dividing, non-loadbearing, vertical construction". In European (CEN) standards it is defined as a non-loadbearing wall and the European Technical Approval (EOTA) Guideline for partitions (ETAG 003) is entitled 'Internal partition kits for use as non-loadbearing walls'.

Whilst the primary function of a partition is for space division within a building, it may also be used to separate areas with different floor levels, e.g., mezzanine floors, or it may be used as an independent lining to an external wall.

The structural and functional performances of a partition may extend from structural floor to structural soffit, but when used in conjunction with a suspended ceiling and/or platform floor, these should abut the partition. In other situations, the structural performance of a partition may similarly extend from the structural floor to the structural

soffit, with the functional performance extending from just above the platform floor to just below the suspended ceiling. There may also be instances where the required structural and functional performances do not penetrate the suspended ceiling and platform floor.

However, it is particularly important that where partitions are providing fire resistance, they should be properly integrated with the associated structures and fire barriers incorporated in line with the partition above the suspended ceiling and beneath the platform floor.

Partitions may be constructed in a variety of ways and the designer's specification will depend on the intended use, performance levels and the standards of finish and appearance required. Partitions may be formed from various types of sheet materials, supported by and concealing timber or metal stud framework, with or without expressed/featured joints. They may also be constructed by using composite panels supported by an exposed framework, or prefabricated panels butted together in floor and head tracks, with or without a supporting frame.

The fire resistance of non-loadbearing partitions is evaluated by BS 476: Part 20: 1987: 'Method for determination of the fire resistance of elements of construction' (which details the general principles of fire resistance testing) and BS 476: Part 22: 1987: 'Methods for determination of the fire resistance of elements of non-loadbearing elements of construction' (which details the procedures for testing partitions).

Under the European regime for fire resistance, the basic principles of the tests are broadly unchanged from the BS (and ISO) method. However, the new EN standards are more rigorous and incorporate some new procedures to satisfy all Member States. Each standard now contains a field of direct application clause, giving the range of constructions that may differ from the test specimen to which the result is also automatically applicable. The two principle methods for partitions are BS EN 1363-1 Fire Resistance Tests – Part 1 – General Requirements and BS EN 1364-1 Fire Resistance Tests For Non-Loadbearing Elements: Part 1: Non-Loadbearing Walls.

For reaction to fire performance four British Standard tests are predominantly used to evaluate the behaviour of partition, wall and ceiling linings. To provide maximum fire safety, the Building Regulations require certain constructions to be made from non-combustible materials. A non-combustible building material is one that satisfies prescribed performance criteria when tested in accordance with BS 476: Part 4: 1970(1984): 'Non-combustibility test for materials', or BS 476: Part 11: 1982(1988): 'Method for assessing the heat emission from building materials'.

At a slightly lower level of performance, a material of limited combustibility is one that satisfies the performance criteria prescribed in Approved Document B when tested in accordance with BS 476: Part 11: 1982(1988): 'Method for assessing the heat emission from building materials'.
In addition, any material with a non-combustible core at least 8mm thick, having combustible facings (on one or both sides) of not more than 0.5mm thick, satisfies the appropriate flame spread requirements by test (e.g.

BS 476: Part 7: 1997 (and 1987): 'Method for the classification of the surface spread of flame of products' and evaluates the ability of a partition, wall or ceiling lining to spread flame over its surface. The result is expressed in terms of classes with Class 1 representing the best performance (low or no flame spread) and Class 4 the worst performance (high flame spread).

BS 476: Part 6: 1989: 'Method of test for fire propagation for products', measures the amount and rate of heat evolved by a specimen whilst subjected to heat in an enclosed chamber under prescribed conditions. The Standard describes the method of computing the results to obtain an index of performance. The higher the index, the greater the contribution the material makes to the fire.

Although neither a test, nor defined by British Standards, the Building Regulations refer to Class 0 when restricting the reaction to fire performance of partition, wall and ceiling linings for certain applications. A Class 0 material has a Class 1 surface spread of flame and fire propagation indices not exceeding 6, with Class I not exceeding 12. Non-combustible materials are defined as Class O.

Under the European 'regime', a material can now be evaluated against a series of six Euroclasses from the highest level of performance, Euroclass A1 (approximately equivalent to non-combustible) to Euroclass E (simple ignitability). Euroclass A1 products are tested using the EN ISO 1716 Bomb Calorimeter and the EN ISO 1182 Noncombustibility test, although some products will be 'deemed to satisfy' the requirements. Euroclass A1 products would normally be expected to have less than 1.0% distributed organic material.

In addition to using one of the tests from the previous paragraph, in which the parameters are the same as those for Euroclass A1 but with different values, products are also tested in the new Single Burning Item (SBI) test. The SBI parameters are rate of heat release, spread of flame, smoke production and the generation of flaming debris. This test will effectively replace BS 476: Parts 6 and 7.

Euroclasses B, C and D products are tested in the Single Burning Item test (SBI) and by use of the small flame test, with a 30 second flame application time. The criteria for the small flame test will be based on rate of flame spread, extent of damage and production of flaming droplets.

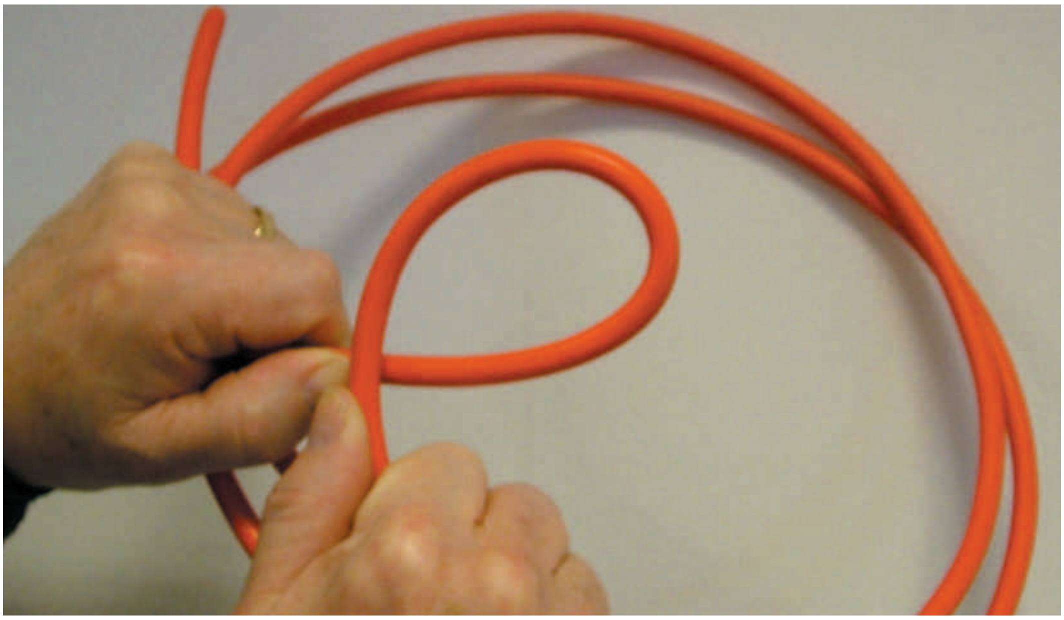
Euroclass E products are tested with a small flame source for ignitability and a spread of flame, both on their surface and within their core. Flame application time is only 15 seconds.

The classification Euroclass F is for products which have either not been tested, or for products that have failed all European reaction to fire Tests.

The results of the appropriate European reaction to fire tests are interpreted into classes by following the procedure given in EN 13501: Part 1 'Fire classification of construction products and building elements, Part 1 Classification using test data from reaction to fire tests'. This converts the values measured of the different parameters from the various tests, into the appropriate Euroclass.

For more information visit the ASFP website (www.asfp.org.uk) and look for the publication section, where you will find 'Fire rated non-loadbearing partitions', which is also known as "The Purple Book". All ASFP publications can be downloaded free of charge. IFP

Second generation Prysmian enhanced cable undergoing handling tests prior to launch at Firex South 2006



Fire Resistant Cables:

Choice or Confusion?

As we enter 2006, it is an opportune time to reflect on the considerable growth in the availability of fire resistant cables on the UK market and some of the problems in selection of the appropriate product for a particular application that this has caused. What is certain is that there are now more manufacturers and fire resistant cable product ranges available than ever before. What is less certain is if this will prove to be to the long term benefit of users.

By Terry Journeaux

Technical marketing manager of Prysmian Cables and Systems Limited

A quick review of the current LPCB "Red book" shows more than 20 manufacturers and nearly 60 distinct product ranges listed "for use in fire detection and fire alarm systems, and other application where specifications call up cables with specific performance in the event of fire." Whilst many of the ranges are not listed against the standards needed to comply with, for example, current UK requirements of BS5839-1:2002 "Fire detection and fire alarm systems for buildings – Code of practice for system design, installation, commissioning and maintenance", even for this particular application, the number of listed "standard" cables has more than doubled and the number of listed "enhanced" cables quadrupled in the last two years.

Comparison with the dire warnings given from some quarters at the time of issue of BS5839-1:2002 that only MICC cables would be able to meet its new requirements is interesting. Three years later, we find an ever increasing number of so called "soft skinned" cables joining the well established brands in the market, listed against both "standard" and "enhanced" requirements.

Whilst such increased choice may appear welcome, it puts a greater responsibility on the user to ensure that a correct choice is made. Important questions need to be asked:

- does the product have all the approvals needed for all potential applications?
- how do the products compare in terms of track record of trouble free installation and performance and ongoing quality of supply?
- are the products technically supported by a manufacturer able to give accurate guidance as to the specification requirements for various applications and able to give the required advice on installation issues such as fixing and jointing?

Even within the fire alarm and emergency lighting area it is often overlooked that different applications have different cable test requirements and that one approval listing does not necessarily cover all applications. Historically, when only BS6387 was in use as the test standard, a Category CWZ listing would cover all fire alarm

and emergency lighting applications.

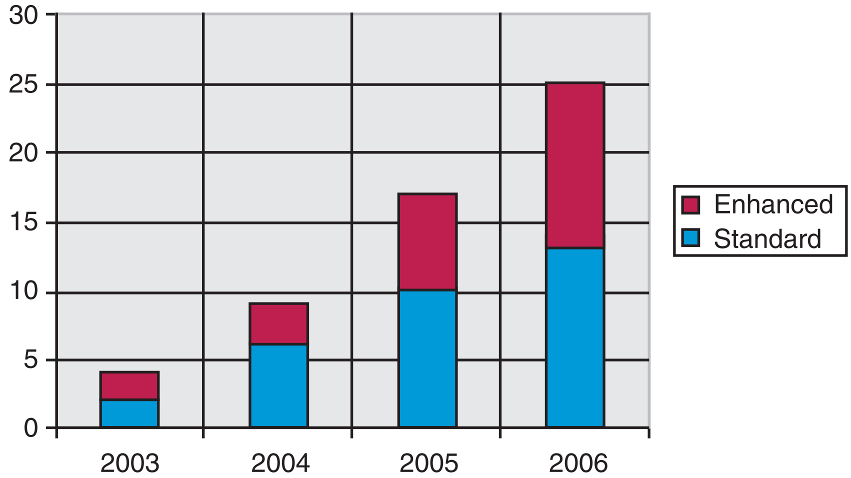
Today, with the adoption of new and different test standards driven both by European harmonisation and a more critical examination of the particular application requirements by the BSI Committees responsible for installation Codes of practice, we see a different picture.

- BS5839-1:2002 "Fire detection and fire alarm systems for buildings – Code of practice for system design, installation, commissioning and maintenance" requires cables for critical signal paths to comply with product specifications BS EN 60702-1 (MICC types), BS 7629 ("soft skin" types) or BS 7846 (armoured types) except that the fire resistance test requirements need not be applied and additionally to comply with the harmonised fire resistance test requirement of 30 min ("standard") or 120 min ("enhanced") to BS EN 50200 and the UK only fire resistance test requirement of BS 8434-1 ("standard") or BS 8434-2 ("enhanced").
- BS5839-6:2004 "Code of practice for the design, installation and maintenance of fire detection and fire alarm systems in dwellings" requires cables to comply with the "standard" test requirements of BS5839-1:2002.
- BS5839-8:1998 "Code of practice for the design, installation and servicing of voice alarm systems" still require cables to meet BS EN 60702-1 (MICC types) or BS7629 ("soft skin" types) including the fire resistance tests. Although BS6387 Category BSWX is actually referenced in BS7629, this requirement is usually taken as the more onerous BS6387 Category CWZ.

  This cable requirement has been confirmed by the December 2005 Amendment to the standard and will be considered further for the next revision expected in 2007.
- BS5839-9:2003 "Code of practice for the design, installation, commissioning and maintenance of emergency voice communication systems" requires cables to comply with the "enhanced" test requirements of BS5839-1:2002.
- BS5266-1:2005 "Code of practice for the emergency lighting of premises" requires cables to meet the harmonised fire test requirement of 60 min to BS EN 50200.

If the complexity of requirements in the fire alarm and emergency lighting area appears confusing, it can be eased by careful choice of product with all the approvals against the necessary test requirements. However, the situation regarding requirements for power cables required to maintain their circuit integrity under fire conditions and to be used in fire fighting, life safety and property protection systems is also in a state of change.

Although the current version of Approved Document B of the Building Regulations states for "protected power circuits" that "A protected circuit for operation of equipment in the event of fire should consist of cable meeting the requirements for classification as CWZ in accordance with BS6387", it has for some time been recognised that this test method, particularly in relation to cable size, voltage rating limitation and multistage test protocol, may no longer reflect the level of performance required by today's fire safety engineered building designs.



	Standard	Enhanced
2003	23	2
2004	6	3
2005	10	7
2006	13	12

LPCB listed standard and enhanced cables 2003-2006

Additionally, further refinement of requirements has led to different survival times being required for particular fire fighting and life safety applications.

This greater emphasis on the integrity of electrical circuits which need to maintain the function safe working conditions of such important equipment and systems has led to the development of much more onerous fire survival requirements. These requirements which involve an integrated fire test with the application of radiation by flame, direct impact and water jet onto the cable sample have been incorporated into the recently published BS7346-6:2005 "Components for smoke and heat control systems – specifications for cable systems". Whilst BS7346-6 is limited such applications as smoke control, motor driven fire shutters and fire barriers and pressurization relief and smoke dampers, it test requirements are being actively considered for other fire fighting applications such as fire-fighting lifts.

Hopefully the current revision of Approved Document B will bring some greater clarity to the situation. Meanwhile, products are available to enable the best practice recommended by the latest British Standards to be implemented. IFP

Prysmian FP200Gold undergoing testing to 60 minute requirement of BS EN 50200

The Construction Products Directive:

Buying in to a New Way of Thinking

Steve Martin, Product Manager with alarm signalling device specialist Fulleon, looks at the Construction Products Directive (CPD) and its impact, both current and ongoing, for manufacturers of fire safety products.

By Steve Martin

of Fulleon

For many organisations within the Fire Industry, the Construction Products Directive (CPD) has begun to take effect and has had a significant impact on the way in which products are designed, verified, promoted and introduced to the market. Even in the UK, where the Directive is not mandatory and has only been 'recommended' by the Office of the Deputy Prime Minister (ODPM), adopting it has meant conducting a substantial re-think on design and manufacturing processes and techniques.

A large number of 'Construction Products' that are incorporated in a permanent manner into a 'Construction Works' come under the scope of the CPD. The Directive lists a number of 'Essential Requirements' for the Construction Works, which assures their suitability in the event of a generally foreseeable event. Fire alarm systems and components are specifically covered under the essential requirement of 'Safety in Case of Fire'.

Compliance with a Harmonised European Standard is the preferred method used to demonstrate compliance with the majority of European Directives. However, in the case of the CPD this is crucial, since the essential requirements do not refer directly to 'construction products' but to the 'construction works' as a whole. This means that you have to meet the requirements of the specifications and tests laid down in the Harmonised European Standard to be able to demonstrate compliance with the CPD. This in itself can be a challenge in the competitive world of the Fire Industry, and has resulted in significant cost increases associated with product verification.

However, the greatest challenges and upheaval have come from the requirement levels for 'Attestation' (or evidence) of Conformity (AoC). There are six levels of attestation, 1+, 1, 2+, 2, 3, 4, where 1+ is the most rigorous. Essentially, the level of attestation required increases with the consequences of a product failure. Fire alarm and detection products and systems have an attestation level of 1, which means that third party testing and assessment is mandatory. Therefore,

unlike most other directives (Electro-Magnetic Compatibility – EMC – for example), you cannot self certify as being compliant to the CPD and are required to engage a Notified Body appointed under the government to conduct your tests and certification.

No matter what the attestation level, all manufacturers need to implement a Factory Production Control (FPC) System under the CPD. In the case of the fire alarm and detection industry, this is also subject to an initial inspection by a Notified Body.

What it means for our industry

The inclusion of a third party product verification, assessment and certification process during the mature stages of a product development project is not new to most in this industry. Product approvals have been playing a pivotal role in product development here for some time. However, whereas a product could be officially launched and the approval noted as pending, this task has now become a critical path process, requiring completion before product launch. This changes the emphasis of the certification process, and therefore requires careful planning if it is not to significantly impact upon project time-scales and cost. Also, as the majority of newly released products will require some level of assessment, there is a greater burden in sheer quantity of product.

The move to mandatory third party testing is already having a wide ranging impact on future product development. A reassessment of almost every aspect of the design-development process needs to take place, from initial market research and product requirement specification, though the design process to the final techniques used for manufacturing and test. Even the way in which products are promoted and the emphasis on their intended uses needs to be considered. A great deal of time, effort and cost can be saved if careful consideration to all these points is given at an early stage. Serious questions need to be asked about product variant breadth, the way in which the range fits together, what common elements can be used across a product line, which specifications are essential to the market, etc.

Before mandatory third party testing was introduced, the majority of the cost for new product

development was in tooling or development of new technology. Certainly as far as Sounders and Callpoints are concerned, mandatory third party testing is likely to be one of the single most significant costs in any product range development project, and can be significantly higher for more complex electronic devices such as fire control panels.

Rising to the challenge

To meet the challenges that the CPD has presented, a new and more global approach was necessary. At Fulleon, we had to look at our entire product range and ask a lot of questions about how the ranges fitted together, looking closely for any redundancy or duplication. Pragmatism is key to a successful approach and some difficult decisions have to be made, but ultimately the effort will pay dividends. It is also very important to inform and negotiate at all levels, both internally and externally. Working closely with our customers and the Notified Bodies has been key to the successes Fulleon has had so far on CPD. Where difficult decisions have to be made, we have tried to involve our customers at the earliest practical opportunity, so that a more sustainable and cost effective solution can be implemented. The whole process can be very slow and pain-staking, but persistence is ultimately rewarded.

What benefits are there in Third Party Testing & Approval Marks?

It must be noted that the designated objective of any of the European New Approach Directives, including the CPD, was to breakdown the barriers to trade within Europe. In theory, its introduction means that a product designed and manufactured in one country can cross borders within Europe without any barriers to its introduction on the market. However, special regional requirements and a lack of 'Agreement of Understanding' between the European Notified Bodies have resulted in some difficulties in this area. There is still no ideal single European product, since special

Additional approvals using national standards are often required to satisfy specific regional requirements and markets, thus resulting in some dilution of the objectives of the CPD.

versions are almost always required for certain markets. In addition, some markets will simply not open up with just a CE mark under the CPD. Additional approvals using national standards are often required to satisfy specific regional requirements and markets, thus resulting in some dilution of the objectives of the CPD. However, these additional requirements can only be just that . . . *additional*, and cannot conflict with or contradict a specific requirement within the official harmonised standards.

The resulting upside of the new approach should be that product quality, performance and reliability improve. However, it is not merely the additional testing and auditing that will lead to this improvement in quality and performance. The requirement for the manufacturer to implement a 'Product Specific' Factory Production Control System should aid the identification of quality issues at an early stage, and thus the implementation of more effective solutions. In addition, as products throughout Europe will now be specified in a more standardised format, a more direct and realistic comparison will be able to be made between like products. The system designer and specifier will now be able to make more informed decisions when comparing and specifying suitable devices. This will result in a more level playing field as manufacturers define and specify using the same rules. Greater exposure of these standardised specifications to the market should result in raising standards as manufacturers' specifications and product quality becomes more competitive. Of course, on the down side there is a danger that

The system designer and specifier will now be able to make more informed decisions when comparing and specifying suitable devices.

the new rules will suppress innovation, increase product costs and extend development times. However, when consideration is given to the fact that ultimately these products are for saving life and property, then surely this is a price worth paying.

Where do we go from here?

Embracing the new approach, rather than implementing the rules because you must, is the key to success with this new legislation. It is important to try and gain some real benefits from the process by realising real improvements in performance and quality. A dramatic increase in sales may not come as a direct consequence of investing in CPD, but it is almost certain that a loss of sales will result if you do not. As expected, the industry is becoming more switched on and is tending to 'self police' the CE requirements. CE marking to the CPD may be optional in the UK at present, but it is important to ensure that you are not caught out if or when it becomes mandatory.

An important development will be the concept of a 'one-stop shop' for European testing and certification. Work is underway to try and achieve greater cooperation between the key Notified Bodies throughout Europe. This must be made a reality in time, if the cost and execution of product certification is to remain viable and fair.

As more harmonised standards are published in the European Official Journal (OJ) over the coming months & years, looking ahead and planning is key. The associated processes are becoming familiar to us all and the lessons learned from the first batch of product certifications should help the next phase to be less painful. IFP

Halon Replacements

Since the banning of halons under the terms of the Montreal Protocol, the fire protection industry has been searching for the "Perfect" replacement. Sadly many in the industry even today have not accepted or realised that it is extremely unlikely that the perfect replacement will be found and fail to understand that compromises have to be made.

By Gerald F. Whitworth, FIMMM

In the early days of direct halon replacement technologies, two schools of thought emerged with and industry largely dividing itself into chemical gas and inert gas "Camps". Considerable time was in my opinion wasted and the resulting confusion caused by the aggressive competition delayed market development and contributed to the significant reduction in the size of the replacement market.

Two decades on from the Montreal Protocol, perhaps it is time to examine whether we have learnt lessons or is the industry continuing to fail its customers by being economic with the truth and not presenting the full facts.

Fortunately, most fire protection companies now, albeit reluctantly accept the need for both chemical and inert gas solutions and usually offer customers the choice.

What are these choices and how should potential users evaluate the data presented by the "Salesman"

The main points to consider can be simplified into 3 topics these, though not necessarily listed in order of importance are the environmental, engineering and cost considerations.

The environmental considerations which have to be taken into account have now shifted from the original one of Ozone Depletion to the perhaps more important topic of Global Warming. The fire protection industry takes its environmental responsibilities very seriously. It has fully engaged in the removal of halons from the market, and has invested very significant investments necessary to seek out lower environmental impact alternatives such as HFCs.

The industry also recognises the need to reduce emissions of HFCs in fire fighting as much as is possible without putting life, property or the environment at further risk.

Inert gas systems are not without cost to the environment, many will count the cost in terms of the vast numbers of storage cylinders that are required, resulting in emissions to produce the energy, a point which cannot be fully ignored, but largely used to justify the need for chemical products.

In my view this is an argument which is not needed, chemical gases can be justified in fire extinguishing applications, to save lives and property, primarily because they combine the essential attributes of being fast acting and they have the ability to be used in confined spaces when humans are present

Currently, there are no more cost-effective replacements for HFC's for use in fire fighting, despite the industries continuing efforts to find one.

The introduction of industry best practices has now ensured that agents such as HFCs in fire fighting are classed essentially as non-emissive.

The controlled use of HFC's including the correct design of equipment and controlled filling procedures together with monitoring, reporting and recover procedures developed by the fire industry, will minimise emissions

In Europe the estimate of HFC emissions from fire fighting applications is estimated to be 0.0005% of the total greenhouse gas emissions by 2010.

Europe is taking a significant lead in its commitment to reducing greenhouse gas emissions and its actions are being monitored and followed by other leading industrial nations.

Resulting from its commitment to the Kyoto Protocol, the EU decided to deal with the three Fluorinated gases ('F-Gases'), HFCs, PFCs and SF_6, at the same time. The Commission undertook several studies, carried out by independent researchers, to ascertain the extent of the problem and how it could best be tackled. One of the key factors was that reductions in emissions of F-Gases should not compromise the phase-out of ODS such as Halons.

The studies by the consultants found that, of the sectors in which F-gases are used, fire fighting is the smallest emitter by a considerable margin. As a result, the studies did not propose limiting the use of HFCs in fire fighting.

Based on these studies, and after extensive consultation and with broad support from industry and NGOs, the European Commission published a draft Regulation on Fluorinated Gases in September 2003.

The aim of the Regulation is to reduce emissions of Fluorinated Gases including HFC's through improved inspection and reporting and, where the studies found it to be necessary, restrictions on use. Although some bans on the use of certain

fluorinated gases were proposed, none included HFCs in fire fighting

In October 2005, the European Parliament considered the Council's Common Position. Again, the Environment Committee endorsed the need for the continued availability of HFCs in fire fighting, stating that, because of the minuscule emissions, it was not worth compromising safety by limiting their use. One MEP pointed out during the debate that the environmental damage which can be caused by allowing a fire to burn often far outweighs the effects of HFC emissions. The Plenary endorsed this view and, as such, there no restrictions on the use of HFCs in fixed fire protection systems are included in the Regulation.

The newer chemical agents introduced to replace have posed new problems to the fire engineer, they are without doubt less forgiving to design malpractice than halon and exhaustive testing was necessary to build confidence into a conservative and safety conscious market.

The industry has spent vast amounts of time and money on the development of the latest system hardware and computer software programs and perhaps the industry now has the safest and most reliable systems than at any other time in its history. This was necessary in order to design systems which provided the level of safety to the user and in the case of chemical systems minimised any emission into the environment and delivered at a cost effective price.

These development programmes were also applied to the new inert gas systems, despite having decades of knowledge from designing carbon dioxide systems, since they were to be used for applications involving "Occupied Areas"

Comprehensive, international standards for system design and installation have emerged, these incorporate test procedures which reflect the risks found in the advancing marketplace.

The requirements of the changing and discerning fire protection market now largely dictate approvals of system hardware, design and installation, with the major suppliers sporting listings from UL, FM, LPCB, gives confidence to the user.

Without doubt, the industry now knows more about the design of fixed fire protection systems, but there is no simple easy solution, and benefits obtained in one area are often off set with problems elsewhere.

Some of the newer and recently introduced chemical systems can offer the user benefits in terms of environmental considerations, but not without significant engineering difficulties, including concerns about the ability to evenly distribute and retain the gas in the protected space necessary to maintain an adequate design concentration to prevent re-ignition.

Doubts have also been raised about the long term health & safety issues concerning some the products not simply following discharge but also during handling and filling of the storage cylinders. In addition and not surprisingly there can be significant increases in cost of the system, due too increase gas usage and or the unit cost of the agent.

Another aspect which should be given to the engineering concepts for halon replacement is the choice given to HFC's compared to Inert gases when a space and or weight constraints exist

The latest news from The European Union with respect to HFC's gives a renewed confidence to fire engineers and end users alike, knowing that already established technologies will be allowed to continue. Also the recognised economic benefits associated with HFC's will allow users to continue to provide adequate safety without the need to take risks by non replacement of fire systems. This aspect is particularly pertinent were systems using HFC 125 are selected on account of their ability to be employed in retrofitting of halon 1301 systems, allowing major financial savings to be made..

In a safety conscious market the question of cost is normally secondary to the technical merits in the selection process, but an increasingly competitive market this aspect is often uppermost in ones mind. This should involve both initial installation cost but also with a view of the future costs associated with refilling with gas in the event of a discharge. The purchaser should also consider the motives of the supplier, who may recommend an expensive chemical product and or a system requiring a high extinguishing concentration, which could incidentally be of high density, remember the cost of gas is based on weight despite the design concentration being based on risk volume.

I mentioned earlier that some HFC systems can be used to retrofit exist halon installations, this type of system offers real benefits to the consumer, requiring little modification to the existing pipework. The result savings in installation cost and disruption to the users business can be significant and worthy of detailed investigation. Many companies purport to offer this type of product but in reality few can actually deliver in practise, either not having the correct product combined with a suitable system design or the required expertise to design and retrofit the system.

HFC's provide economic alternatives to halons, supplies of both systems and bulk gas are widely available, with no one company holding a monopoly on supply of the hardware and more importantly gas supply.

The engineering of the systems is now well proven with systems being designed to and installed against demanding international standards, the technology of which follows closely in the footsteps of halons employing low pressures.

Exhaustive health and safety studies have be carried out on the chemicals, which have been available and widely used in a wide variety of industries for many years. New standards for the determining and controlling acceptable and safe levels of exposure to the gases have been introduced providing confidence for the end user.

The safety aspect of system design should not be overlooked when comparing the merits of the various alternatives, inert gases can pose system designers with serious safety problems. This manifests itself especially when determining actual design concentration in applications were difficulties exist in calculating accurately the net volume of the protected space, since a small window of safety exists between the ability to extinguish the fire whilst still meeting safe exposure levels.

HFC's are now destined to provide the fire protection industry with a sustainable alternative for halon replacement and this should allow end users to pursue a continued change out of environmentally damaging halon with renewed confidence. IFP

Gerald F. Whitworth, FIMMM

Currently
Independent consultant, specialising in fire protection and related environmental issues

1991-1999
Sales & Marketing Manager (Fire Chemicals), Ausimont UK Ltd
Sales and market development of fire chemicals for Halon replacement, in UK and international markets

Pre-1991
Career in sales and marketing, specialising in fire retardant engineering composites and flame retardants used in electrical, electronics, aerospace and telecom markets

Conference Papers

1994
British Fire Protection Systems Association London UK
"Drop In" Replacements for Halon 1301 Fire Protection Systems

1996
International CFC Conference Washington D.C. USA
Comparative Testing of Halon Replacements at Loss Prevention Council UK

1997
Fire India Exhibition & Conference Delhi India
Halon Replacement Products, Technical and Economic Benefits

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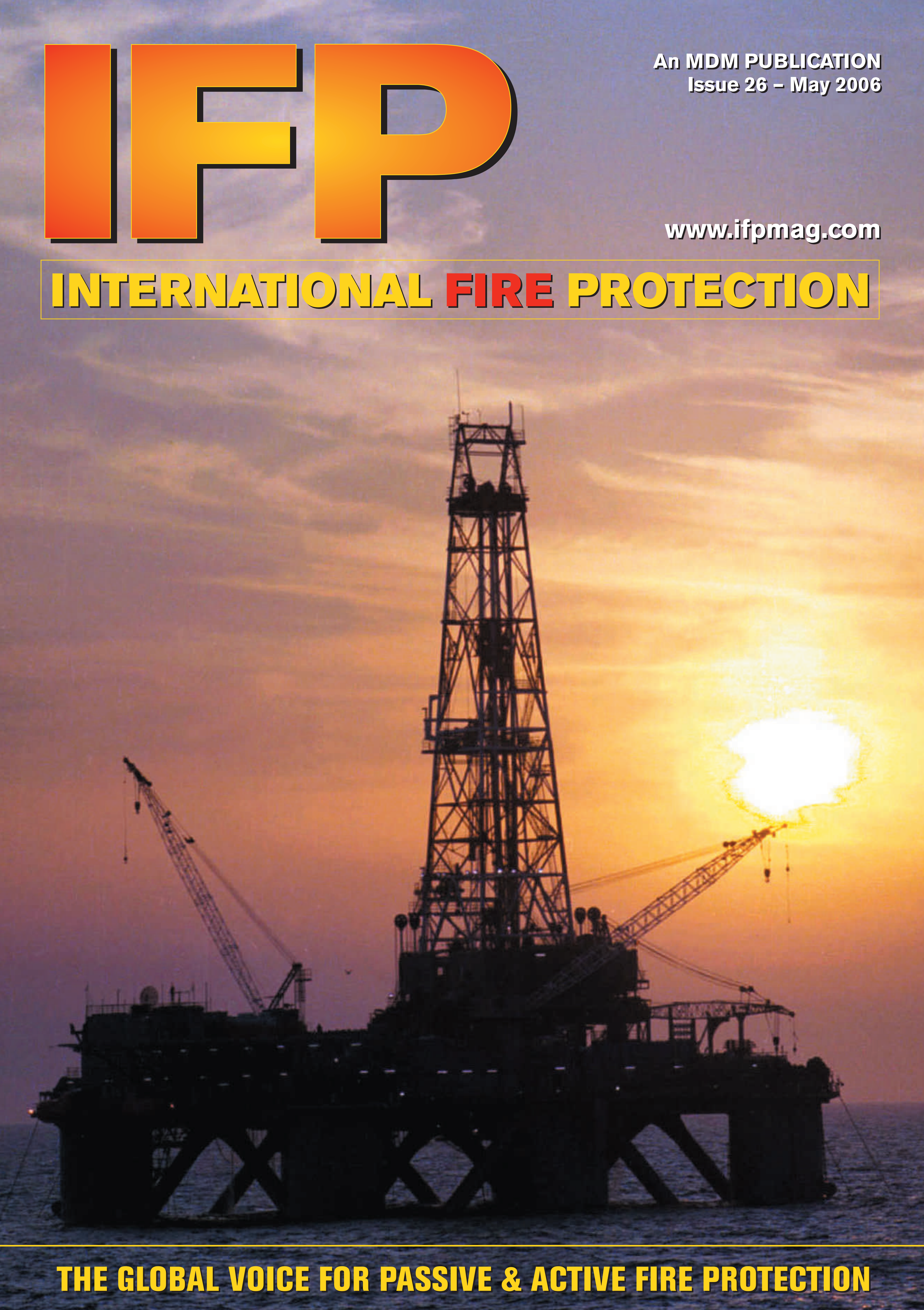

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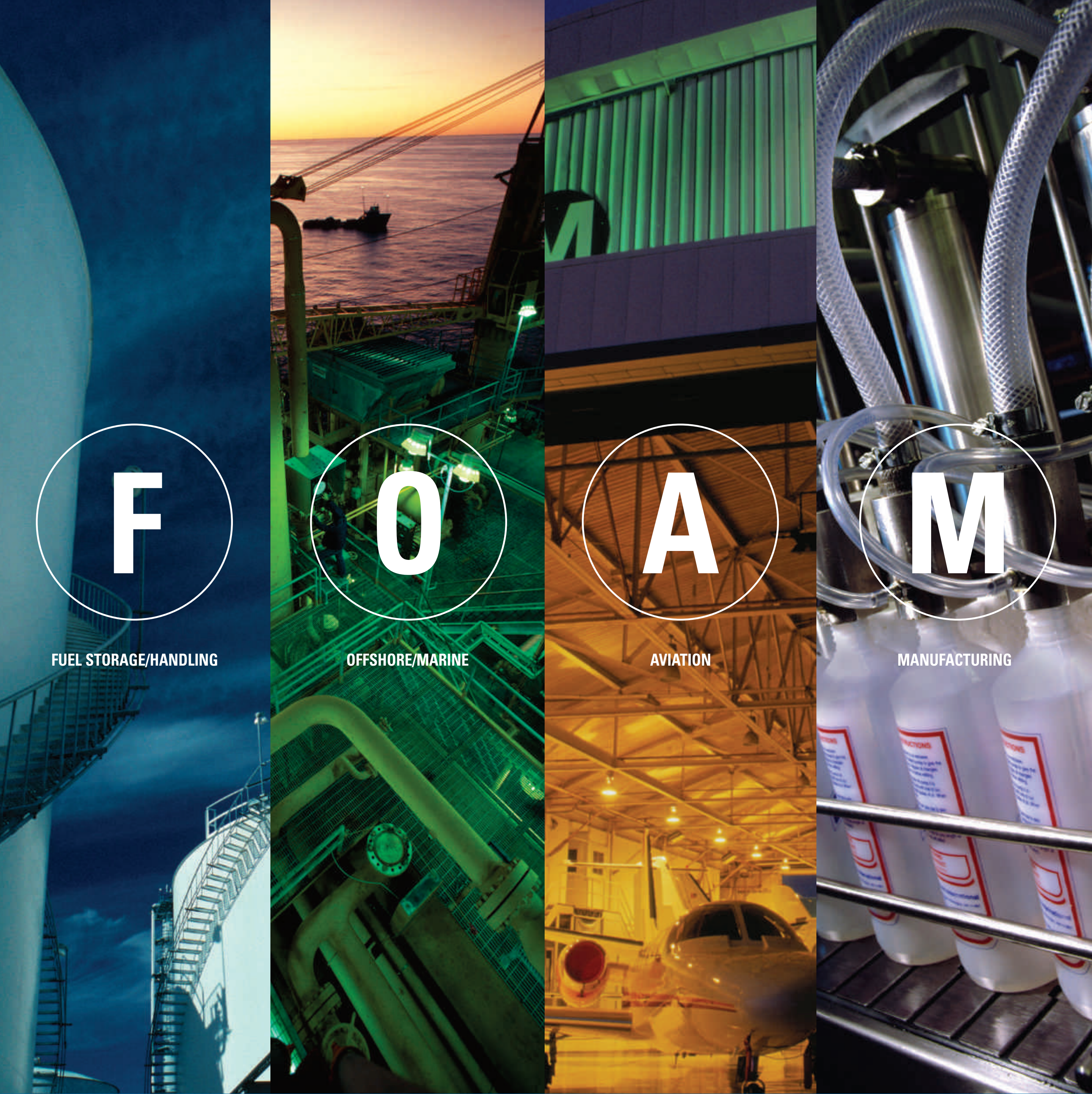
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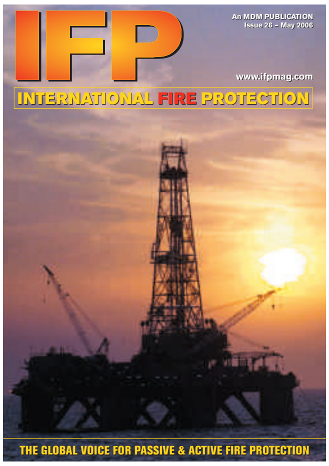

Front Cover Picture: THE 'DEDE GORGUD' OIL PLATFORM IN THE CASPIAN SEA. The sun sets over the 'Dede Gorgud' drilling platform that extracts oil from vast reserves beneath the Caspian sea. WAW/WS ENERGY AZERBAIJAN AIOC BAKU Photo by STR. © REUTERS 1999. 21/09/1999

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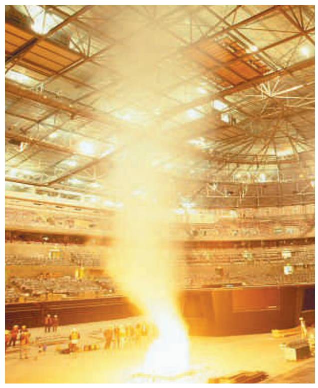
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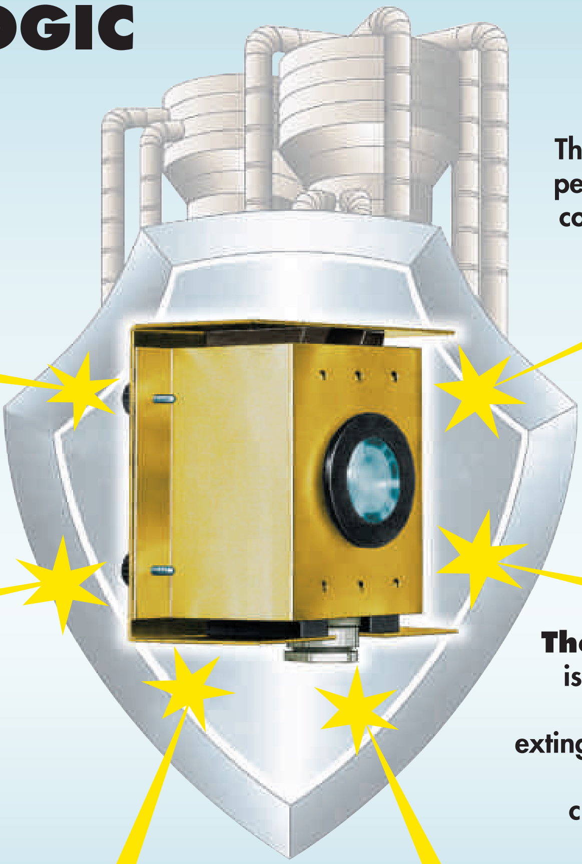
CONTROL LOGIC Spark detector

designed for dust collection systems to protect storage silos from the risk of fire.



Sparks fly at high speed.

They travel at a hundred kilometres per hour along the ducts of the dust collection system and reach the silo in less than three seconds

The CONTROL LOGIC SPARK DETECTOR is faster than the sparks themselves. It detects them with its highly sensitive infrared sensor, intercepts and extinguishes them in a flash. It needs no periodic inspection.

The CONTROL LOGIC system is designed for “total supervision”. It verifies that sparks have been extinguished, gives prompt warning of any malfunction and, if needed, cuts off the duct and stops the fan.

ISO 9001

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E-mail: controllogic@controllogic.it - Web: www.controllogic.it

CONTROL LOGIC s.r.l.

BETTER *TO KNOW* IT BEFORE

Eye is faster than nose.

In the event of live fire
the IR FLAME DETECTOR
responds immediately

CONTROL LOGIC
IR FLAME DETECTOR

the fastest and most effective fire alarm device for industrial applications

IR FLAME DETECTOR
RIV-601/FA
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ENCLOSURE

For industrial applications indoors or outdoors where is a risk of explosion and where the explosionproof protection is required.
One detector can monitor a vast area and responds immediately to the fire, yet of small size.

Also for
RS485 two-wire serial line

IR FLAME DETECTOR
RIV-601/F
WATERTIGHT
IP 65 ENCLOSURE

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CONTROL LOGIC s.r.l.

Notifier by Honeywell provides full fire protection for De La Warr pavilion

Sovereign Alarms installs ID2000 fire alarm panel as part of £8 million restoration project

Following a major £8 million restoration and redevelopment programme, completed recently, Bexhill's famous De La Warr Pavilion incorporates full fire protection system utilising a Notifier by HONEYWELL ID2000 SYSTEM.

The Pavilion, built in 1935 in the Modernist style, re-opened in October 2005 with the support of Arts Council and Heritage Lottery funding and today incorporates a 1,000 seat theatre, restaurant and bar and one of the largest contemporary art galleries in the South East. "It was essential to provide an addressable, L2-graded fire protection system which met current all building requirements including BS5839 certification," confirms Colin Chadwick, commercial director at Notifier Engineered Systems Distributor (ESD), Sovereign Alarms.

Brighton-based Sovereign Alarms installed the new Notifier ID2000 protection system following a competitive tender process and has been working with Notifier by Honeywell for some 15 years.

"Notifier systems are ideally suited to leisure facilities and public arenas such as De La Warr," says Chadwick. "The ID 2000 is a typical example, providing a highly cost-effective, fully addressable, intelligent fire protection system which is easy to install, programme and operate."

Sally Ann Lycett of De La Warr Pavilion agrees and adds: "Notifier is exactly what we were looking for in terms of providing a high level of protection for visitors, our staff and the magnificent building itself. It combines robustness and reliability with the flexibility required to meet our wide ranging needs."

Work is underway to provide extra workshops at the De La Warr Pavilion and Sovereign Alarms will provide additional smoke detectors and devices for the new facilities which are planned to open later this year.

For further information contact:
Graham Campbell
Honeywell Fire Systems
Tel: +44 (0)1444 238424
Email: graham.campbell@honeywell.com

Sara Mudalige appointed as Klaxon's new sales engineer

Sound signaling specialist KLAXON has appointed Sara Mudalige as its new Sales Engineer.

Sara studied Engineering at Undergraduate level and Management at Postgraduate level at the University of Manchester Institute of Science and Technology. She joined Klaxon Signals after graduating and hopes to play a key role in generating new sales leads by analyzing potential market behavior. She is also involved in maintaining existing customer accounts and handling incoming technical queries.

Klaxon has been a leader in the manufacturing of sound signaling equipment for over 80 years. Its product range includes electronic sounders, sirens, bells, buzzers, hooters, airhorns, fire alarms and beacons for fire, security, industrial, transportation and wide area signalling applications.

For more information, please visit the company's website at www.klaxonsignals.com

Easy AV™ – The Smart Strobe Conversion

VIMPEX has launched Easy AV™, an innovative way to convert existing installations of Besson's Banshee and Bedlam‡ as well as Fulleon's Roshni* sounders to DDA-compliant sounder/strobes. The Easy AV™ is an ingenious strobe ring that retrofits onto existing Banshee and Roshni products without the need to remove the existing wall mounted base or change the wiring.

The Easy AV™ is supplied with handy flying leads that allow quick and easy installation in less than 3 minutes – all you need is a screwdriver.

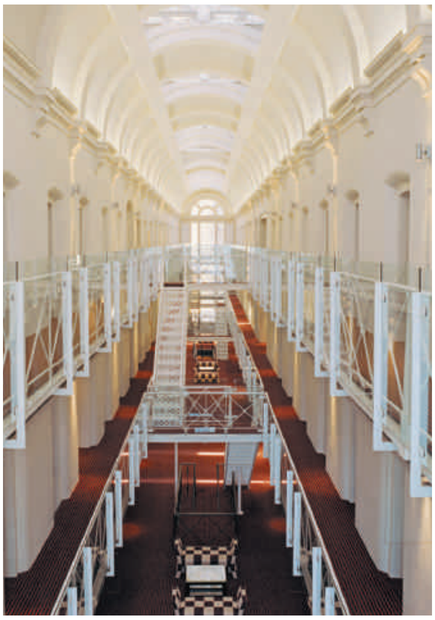
Easy AV™ incorporates a high output dual strength LED strobe that makes it a cost-effective solution for DDA compliance. As it is powered from the sounder circuit, Easy AV™ requires no additional power supplies. Its low current consumption means that in most cases the existing sounder circuit supply current will be sufficient without the need to upgrade power supplies.

Easy AV™ together with Vimpex's existing MT range of sounders and strobes provide cost-effective solutions for all new and existing DDA compliant fire alarm applications.

For further information contact:
Vimpex Ltd.
Tel: +44 (0) 1702 216 999
Fax: +44 (0) 1702 216 699
Email: sales@vimpex.co.uk
Website: www.vimpex.co.uk

Easy AV™ is the smart way to convert existing installations of Besson's Banshee and Bedlam as well as Fulleon's Roshni sounders to DDA-compliant sounder/strobes.*

Fire-Cryer® Assists Prison Escape



The luxury Malmaison Hotel, converted from a former prison

FIRE-CRYER® multi-message voice sounders have been installed as part of a DDA-compliant fire alarm and voice evacuation system in the new luxury Malmaison Hotel in Oxford. The former prison has been converted into a luxury hotel as part of the multi-million pound Oxford Castle Project which includes apartments, shops, restaurants and a museum.

The system, installed by the specialist fire systems company, Pyrotec Services Limited, comprises of over 200 Fire-Cryer® voice sounders which were installed on the standard 2-wire sounder circuit. The Fire-Cryers® provide a simple, cost-effective voice evacuation solution, with up to four voice messages that are both heard and understood.

Fire-Cryer® requires no special wiring and can be retrofitted to existing installations. The units can be fully synchronised and have a low current consumption allowing simple replacement of existing sounders and bells. The Fire-Cryer's® multi-message capability also ensures that 'system test' and 'all clear' messages can easily be transmitted avoiding confusion with the fire/evacuation alarm.

For further information contact:
Vimpex Ltd.
Tel: +44 (0) 1702 216 999
Fax: +44 (0) 1702 216 699
Email: sales@vimpex.co.uk
Website: www.vimpex.co.uk

Maintenance-free personal monitoring for two years with new Draeger Pac 5000

With an event logger for computer downloading, the new DRAEGER PAC 5000 single gas instrument is ideal for use by those with a need to carry out regular personal monitoring and to record the results. Easy to use and completely maintenance-free for two years, it ensures reliable monitoring of ambient air and is designed to detect carbon monoxide, hydrogen sulphide or oxygen.

As the latest addition to the Draeger Safety range of innovative single gas instruments, the Pac 5000 can be viewed at www.draeger-safety.co.uk/PAC.

Featuring a back-lit liquid crystal display which continuously shows the gas concentration in large digits, this small, robust unit incorporates the new Draeger XXS sensors. These sensors, which do not have to be replaced during those two years, ensure extremely short electrochemical reaction times and enable the unit to respond immediately to any gas hazard.

Equipped with vibrational, visual and two-tone audible alarms which are activated as soon as the threshold levels are reached, the Pac 5000 also emits an alarm before the end of the instruments' useable life and before the end of the battery capacity. Depending upon the selected configuration, the pre or main alarm can be acknowledged.

Configuration, calibration and downloading of the event logger can all be carried out quickly and easily via the infra-red interface, and the event logger can store up to 60 events.

Downloading the stored data, complete with date and time, can be carried out via a PC using Pac Vision, CC Vision or Gas Vision software. An adjustable operating timer function can also be accessed with this software to allow changes to a number of specific operations such as calibration due date, inspection due date or a special out of order date.

For maximum reliability, the language-free display also features a bump test icon that informs the user as and when a function test is required. The bump test period can be adjusted by the user and performed either manually or automatically, the result being stored in the event logger. This can be easily carried out with a Draeger Bump Test station.

Several instruments can also be configured and calibrated at the same time with the Draeger E-Cal system.

Protected by a tough, rubber housing and meeting the requirements of IP65, the Pac 5000 is easily fastened to workwear by way of a secure crocodile clip.

Full details can be found at www.draeger-safety.co.uk/PAC.

Further information is available from:
Richard Beckwith
Draeger Safety UK Limited
Ullswater Close, Kitty Brewster Ind Est., Blyth, Northumberland NE24 4RG
Tel: 01670 352891
Fax: 01670 356266

Crowcon appoints new technical director

CROWCON DETECTION INSTRUMENTS has appointed Stefan Kukula as its new Technical Director.

Stefan joins Crowcon from The Morgan Crucible Group of Companies, where he developed products based on materials technology and advanced engineering in fields as diverse as fire protection, casting processes and electronic devices. Prior to this he was head of the CAE team at Dyson.

Before joining Dyson Stefan spent six years with Kobe Steel in Japan, where he set up and managed a team doing consultancy design analysis for clients such as Nokia, IBM Japan, Sony, Casio, Acer, Apple and Singer Industries. He was the first foreign employee of Kobe Steel to receive the President's Gold Award.

Stefan, who speaks fluent Japanese, has an Engineering degree from Cambridge University, as well as an MSc in Composite Materials and a PhD in Engineering, both from Imperial College, London.

For further information contact:
Crowcon Detection Instruments Ltd
Tel: +44 (0) 1235 557700
Fax: +44 (0) 1235 557733
Website: www.crowcon.com

"Sabratha" Platform built for Saipem by Hyundai

Fire-resistant cable transits, system "Quick-Fix TCM" from bst-firestop.com

"Sabratha", the first Libyan offshore gas platform, was planned by an international consortium headed by the Eni-Saipem Group/Italy and its partner NOC (National Oil Company) Libya and will be used for the development of the Bahr Essalam field, 110 kms from the Libyan coast. The Technip-designed platform consists of a 202 m high, eight-legged fixed steel jacket (for a water depth of 190 m) weighing 22,000 tons, and a single 12,000 ton integrated deck, a so-called "Topside". In addition, the platform is equipped with a 117 m high flare boom (718 tons), fast moving haulage rig (800 tons) as well as living quarters (capable of accommodating 110 people) and a helideck.

The platform was ordered by the Libyan branch of AGIP Gas B.V. in June 2002. After slightly more than two years of construction work at Hyundai Heavy Industries, Ulsan/Korea, the platform was put into operation beginning of 2005.

The entire Western Libyan Gas Project involves the development of the onshore field Block NC-169 nearWafa in the Sahara desert and the offshore field Block NC-41 (Sabratha) in the Gulf of Gabes, as well as the transportation of the gas from the fields to a gas processing plant in Mellitah (on the coast) and then by an export pipeline to Sicily and the Italian natural gas grid. The gas, crude plus condensates produced at Wafa is conveyed to the Mellitah plant through two 540 km long pipelines. At full capacity the plant will produce 4 billion cubic meters of gas each year. The key to the offshore gas recovery is the SABRATHA platform, one of the world's most sophisticated jacket platforms. No wonder that Hyundai invited only the global technology leaders to bid for the multitude of equipment required, among them also the Fire Stop Cable Transits. "That's why the platform is equipped with bst Quick-Fix TCM technology" stated H. N. Han, president of Dong Nam Engineering, bst's distributor in Korea.

The advantages of the bst system Quick-Fix TCM at a glance: fire-resistant, gastight, watertight and explosion-proof! It is a modular Multi Cable Transit System with inserts adaptable to each cable diameter. Easiest planning (software!) and assembly, flexible for later installations, re-usable system parts, checkable safety. Certificates and approvals for each kind of application. Some like it hot – we don´t. IFP

The Sabratha platform during construction

For further information please contact:
BST Brandschutztechnik Döpfl GesmbH
Tel: +43 1 97 0 97 0
Fax: +43 1 97 0 97 18
www.bst.co.at

Born Out of Experience

SPP Pumps is the world leading specialist manufacturer of quality fire protection pumping packages and has been working with consultants, contractors, installers and end-users for more than a century to achieve the most cost effective fire system pumping solutions.

It is no wonder that since SPP Pumps was formed in 1875, it has built a reputation for quality and value that has made it unquestionably the leading supplier of Approved Fire Protection Pumping Packages throughout the world.

This is particularly true for fire protection systems where they are only as strong as their 'weakest link' and compromise may result in avoidable loss of life or property.

That is why SPP fire pumps are designed specifically for the very particular needs of fire protection and are approved by most of the major fire protection bodies around the world. You will find SPP fire pumps in many major airports, oil & gas installations, in many of the tallest and most prestigious buildings around the world and in the channel tunnel between the UK and France. In fact, you will find SPP fire pump products wherever people and property need to be protected from the devastation of fire.

Approved and Listed Fire Pumps

SPP has one of the biggest ranges of approved and listed fire pumps in the world complying with the demanding requirements of the UL and FM approval standards and meeting all the requirements of NFPA 20. Along with these approvals SPP's fire products are also approved for use in many other markets such as Europe, Far East, Middle East, Africa and approval has recently been won to supply fire products into the Chinese market.

Being the first to achieve fire pump approval and listing by the internationally recognised Loss Prevention Certification Board the company today has more pumps approved by the LPCB than any other manufacturer.

Equipment Design

SPP are at the forefront of technological development in fire pump packages. Using computer aided design facilities, experienced engineers are ready to meet precise project needs – no matter how complex. All pumps and controllers are manufactured to the highest engineering standards. They are specifically designed to meet the detailed requirements of the different fire rules and regulations in force around the world.

Unrivalled experience in design and manufacture together with advanced computerised testing ensures utmost equipment reliability. By manufacturing the pump and control equipment, a totally integrated SPP package fully engineered to meet customer requirements is provided. All this is backed up by unrivalled after-sales service and planned maintenance programmes.

SPP offers the ultimate service across the complete range of fire protection pumping and control equipment, whatever or wherever the installation.

Tested and Proven

Once built, SPP fire pump packages are tested on one of the most advanced computerised pump test facilities in Europe.

Comprehensive tests on pump performance, mechanical and electrical integrity and overall package operation reinforce the reputation for reliability that the SPP name enjoys around the world.

SPP's range of Split Case, End-Suction and Vertical Turbine pumps can be found in most types of installation around the world including:

- Office buildings
- Hospitals
- Airports
- Manufacturing facilities
- Power stations
- Pharmaceutical facilities
- Warehouses

Typical applications include:

- Sprinkler systems
- Hydrant systems
- Deluge systems
- Monitor systems
- Water curtain

Customer Care

SPP provides complete service support for all equipment supplied worldwide. In the UK there are strategically placed multi-disciplined service engineers equipped to carry out installation, commissioning and service work.

Overseas, a network of SPP offices, agents and distributors provide the most comprehensive product support in the pump industry with a level of customer care second to none. IFP

For further information please contact:
SPP Pumps
Tel: +44 (0)118 9323123
Fax: +44 (0)118 9303259
www.spppumps.com

Reflective smoke detector saves time and effort

Designed to protect buildings with high ceilings and open spaces, the Fireray Reflective smoke detector from FIRE FIGHTING ENTERPRISES combines an infrared transmitter and receiver in a single unit, making routine installation simpler and faster.

An infrared beam is projected onto a small, high-precision prismatic reflector mounted on the opposite wall. The reflector returns the beam to the transmitter/receiver unit, where the signal is analysed for smoke presence. In suitable buildings, this "all-in-one" design can achieve significant cable savings over detectors which use separate transmitters and receivers.

An optional low-level controller allows authorised personnel to carry out alarm tests from a convenient location, without the lengthy and potentially expensive process of accessing detectors installed at height.

Correct alarm function can be checked using a simple key switch on the controller. Also featured is a serial port which allows the detector's output signal to be checked using a laptop computer. Long-term diagnostic checking is possible if a datalogger is used.

Two versions of the detector are available to cover distances up to 50m and 100m. Correct installation is ensured by a simple alignment aid: coloured flashing LEDs indicate when the detector is precisely aligned with the reflector for optimum signal strength.

Automatic drift compensation prevents unwanted alarms caused by a gradual build-up of dust on the detector, or movement of the building. Supply voltages of 12V DC to 24V DC can be used, and current consumption is very low – only 4mA at 24V in the quiescent state.

For more information please contact Fire Fighting Enterprises at www.ffeuk.com

Klaxon's high output xenon beacons ideal for multiple applications

The latest addition to KLAXON SIGNALS' Sonos range of fire alarm devices is the high output 5J xenon beacon. Supplied with a deep base as standard, the beacon is weatherproof to IP65.

Specifically designed for use in applications where a greater light output is required, for example in fire alarm systems installed in industrial or dirty applications, it is also ideal for use in heavily populated plant rooms where light reflection off equipment surfaces is required.

The Sonos xenon beacon utilises a full faced, translucent lens rather than a separate add-on beacon, giving a much larger surface area. This results in a far greater light output for a more effective warning. The beacon's flash rate can also be selected using a dip switch positioned on the underside of the unit.

Installation is quick and simple thanks to the unique Timesaver® Base. This allows all cable connections to be terminated in the base and not at the head. The beacon's head simply 'twists and clicks' into the base, thus avoiding the wiring and connection problems associated with traditional sounders. Additionally, the deep base has been designed for smooth flow cabling and requires no locking screw.

The base units can be specified in either red or white, with a choice of red, amber or clear lens colours. The beacon is available in either 10-60V DC or 110/230V AC variants.

For more information visit the company's website at www.klaxonsignals.co.uk

ASFP stalwart retires

Ron Smith (far right), the UK Association for Specialist Fire Protection (ASFP) well-respected Technical Officer, has recently retired after fifteen years of outstanding and dedicated service to the construction and passive fire protection (PFP) industry. At the Association's recent AGM, Ron was presented with a flight in a Tiger Moth biplane as a tribute to his time with the organisation.

Bill Parlor, also very well-known within the PFP sector, has been appointed as Ron's successor and is currently responsible for the duties of ASFP Technical Officer.

Ron has been involved with PFP matters for the best part of the last thirty years. He has been the driving force behind many editions of the authoritative publication 'Fire Protection for Structural Steel in Buildings' (also known as the Yellow Book) which is a referenced source of information in the England and Wales Fire Guidance Document B.

He has Chaired BSI and Third Party Certification Scheme committees addressing fire protection, which have led to significant improvements in the level of safety in UK buildings. In addition, he has been a key committee member of many European fire committees (for example, CEN TC127, Fire Sector Group of Notified Bodies) and whilst promoting the best possible practice for fire protection in buildings, has also helped protect the interests of UK business.

Ron's reputation within the UK fire protection business has been such that he was often called upon for assistance by many parties, including government, when a really authoritative view was required. He provided help and encouragement to many new UK fire companies, in their formative stages, in order that they could eventually contribute additional revenue for 'UK plc'.

The ASFP can be contacted at:
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Fax: 01252 739140
Email: info@asfp.org.uk
Website: www.asfp.org.uk

Fixed gas detection sys

Decisions based on compliance with standards

Until recently, manufacturers of gas detection systems, installers, general contractors and "end-users" could rely on only a few reference standards for the manufacture and installation of fixed gas detection systems, which were not mandatory and were sometimes unclear and incomplete.

With the introduction of the two Directives and the new standard for functional safety (see Fig.1, The Sensitron Hexagon), all these subjects will be able to refer to a specific source. Thus, this decision shall no longer be optional, but binding and shall include disciplinary provisions and sanctions.

The most important factors that need to be taken into consideration for the selection of the most appropriate gas detection system will be dealt separately in an abstract divided into 4 parts, each one examined individually.

Directive 94/9/EC, introduced on July 1st and known as ATEX 100a (from the French acronym ATmospheres EXplosives), establishes the ESR (Essential Safety Requirements), specifies provisions for the manufacture of equipment depending on the degree of the hazard of the area, outlines the procedures which have to be followed to certify the equipment, identifies the notifying bodies authorized to certify this kind of equipment and illustrates the procedures which have to be followed to monitor the manufacture of equipment suitable for the above-mentioned areas.

The Directive also specifies the PERFORMANCE that this equipment should exhibit to be regarded as SAFETY DEVICES, regardless of whether they are fixed or portable: a factor that is often neglected and not implemented by local bodies. In other words, a device with an ATEX certified housing does not have the necessary requirements to be certified as a gas detector. In accordance with the Directive, a device can be classified as such only if it is certified in accordance with the performance criteria defined in the Directive and more specifically in standard EN 61779-1 and subsequent amendments. Manufacturers who fail to comply with this standard, installers who install, and users who use devices which are not certified with this standard, will not comply with the Directive, because devices that are regarded "gas detectors (Safety Device)" are not simply devices fitted in a ATEX certified housing.

The Directive ATEX 100a will be examined in greater detail in part 2 of the above-mentioned abstract.

Directive 1999/92/EC, also known as Directive ATEX 118a, will come into force on July 1st 2006.

While Directive 94/9 focuses on products and was addressed mainly to manufacturers of gas detection systems, this Directives applies in particular to the installers and users of said systems, because it specifies the minimum requirements which need to be met to enhance the safety and protection of the health of workers exposed to the risk of atmospheres classified as potentially explosive.

The Directive explicitly lists the duties of "Employers" in terms of classification of the area and the actions that have to be implemented to prevent and/or foresee adequate protective measures against explosion hazards.

This Directive follows Directive 89/391/EEC, whose purpose was to implement, document and update explosion hazards. In Italy, D.L. (Law Decree) 233/2003, which came into force on 10.09.2003 and integrates the general duties specified in D.L. (Law Decree) 626/94, specifies that employers have to perform specific assessments and also prepare specific documents detailing the measures implemented to prevent said hazards. The law decree also specifies sanctions for the failure to comply with these requirements.

All working sites used for the first time after July 1st 2003 must immediately comply with the Directive, while existing ones shall have to do so by June 30th 2006.

A more detailed analysis of the duties of the employers and of the classification of these areas is provided in point 3 of the above mentioned abstract.

The first part of the document examines the basic concepts of gas detection, with topics that range from the specific nature of gases, the concept of explosiveness, the Minimum Ignition Energy (MIE) and toxicity.

These concepts are essential to understand that process followed by law issuing bodies to create and issue the two above-mentioned directives and other European Standards (EN), to which CENELEC 31 and 31-9 Committees have greatly contributed.

The incorrect interpretation or the lack of information on these basic requirements, which include concepts like specific density that is important to determine the correct location of detectors, or the selection of improper detection principles for a specific gas may have a negative impact, even if the detector has been manufactured and tested according to the standards.

The last part of the document, part 4, which is equally important, examines the new European Standard EN 50402 which has been approved in the last few days and which examines the concepts of "Functional Safety", i.e. the reliability of a gas detection system.

Although it is important to verify that the gas detector is manufactured in accordance with the explosion and electrical requirements of the area in which it will be installed, correctly classify the area on the basis of specific criteria, assess risks and correctly install the detectors, it is equally important to assess and classify the equipment or gas detection system also in terms

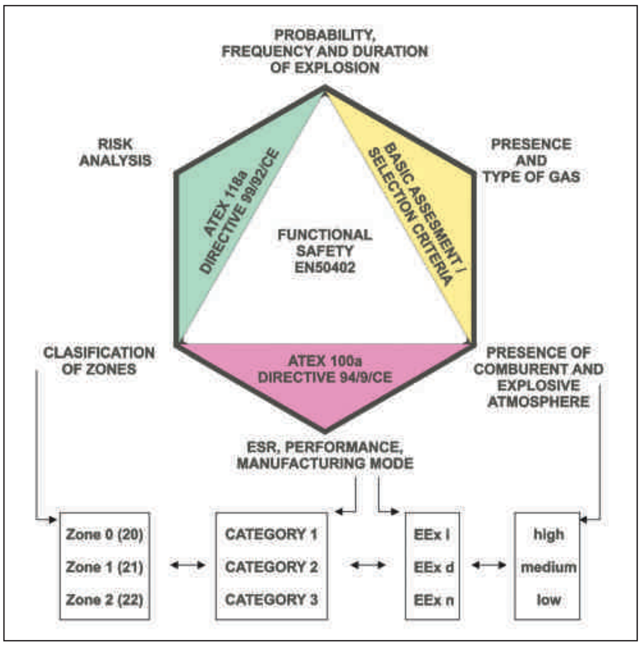

Fig. 1 The Sensitron Hexagon

tems from Sensitron srl

of functionality or probability of failure.

Standard EN 50402 (which is a standard, not a directive) classifies systems in several levels that enable users to ensure that the reliability of the gas detection system complies with the reliability of other systems already installed in the production area.

More specifically standard EN 50402 – "Electrical Apparatus for the detection and measurement of combustible or toxic gases or vapors or of oxygen. Requirements on the functional safety of fixed gas detection systems" – defines the functional modules and illustrates the combinations that can be used for safety purposes.

The document also examines the evolution of the process which has led to the unification of general standards into a single draft and explains how to classify traditional gas detection systems in accordance with the new standard.

Directive Atex 100a establishes that all European countries must carry out type tests on:

- Gas detection systems with measuring functions aimed at preventing explosions, as per EN 61779-1 and subsequent amendments
- The requirements which need to be followed to measure oxygen, as per standard EN 50104
- Gas detectors that have to be used to measure toxic gases, as per standard EN 45544-1 and subsequent amendments

All these measurement standards define standard performance requirements, but do not provide information on functional safety in the event of failure or on the requirements that have to be met to guarantee continuity of operation in the event of failure.

Currently used gas detection systems have a complex modular structure, are controlled by microprocessors and are used for the most diverse applications with varying levels of safety. The complex range of measurements that have to be performed to ensure functional safety are now disciplined by this standard.

The general standard that disciplines the "functional safety of electronic systems" is standard EN 61508, which defines specific performance requirements depending on the level of safety (from SIL 1 to SIL 4, Safety Integrity Levels).This standard, which is constituted by 7 sections, is very large, but also rather generic. In most cases, the standard provides only theoretic guidelines or recommends the use of complex mathematical calculations to estimate potential risks.

All this is very challenging from the scientific point of view, but not very practical.

The second European standard that disciplines the functional safety of electronic control systems is standard EN 954-1, which specifies the generic requirements

Fig. 2 EEx d and EEx n gas detectors

of the Machinery Directive in function of the categories of risk (from Cat 1 to Cat. 4). By definition, these categories are explicitly "not hierarchic in terms of requirements", but can be integrated in a hierarchic system. The definitions of standard EN 954-1 are much more pragmatic and in many cases much more practical than those of standard EN 61508.

The scope of standard EN 50402 is that of unifying (combining) the concepts and of defining the requirements for a family of products, or in other words of specifically adapting generic requirements to gas detection systems.

The basic approach of this new standard is to supply a unique description of gas detection systems, which may be constituted by different hardware components, depending on manufacturers. Gas detection systems are specifically divided into functional modules. The standard specifies, for each module, detailed requirements, dividing them by levels which range from SIL-C 1 to SIL-C 4 (Safety Integrity Level Capability).

Depending on manufacturing characteristics, functional modules may belong to different hardware components. The standard describes the following functional units:

- Gas sampling (4 different modules)
- Sensor
- Signal transmission (2 distinct modules)
- Input to control units (5 distinct modules)
- Processing of signals in the control unit (5 distinct modules)
- Outputs from control unit (5 distinct modules)

Risks (Fault tolerance) are estimated by comparing the percentage of safety relevant faults with the total faults, taking into accountant the redundancy level defined in standard EN 61508. Risks are divided into risks related to simple modules (faults with non predictable characteristics) and complex modules (like microprocessors).

Fault probabilities have been formulated taking into account previous experience with gas detection systems and the practical applications of standard EN 954-1 within the ambit of the Machinery Directive.

The integration of gas detection systems in a global safety system offers the possibility of carrying out a larger number of risk analyses (ATEX 118 a) and of managing risks more effectively. In future, there will be an increasing number of application specific gas detection systems based on the SIL-C classification

Sensitron srl, which has always developed innovative gas detection systems and promoted manufacturing processes focused on quality and the compliance with standard, shall be happy to provide the abstracts of parts 1-4 quoted in this documents to anyone having interest therein. IFP

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Bosch launches new version of TÜV approved Praesideo PA and Emergency Sound System

- **Enhanced flexibility in system design**
- **Increased cost-effectiveness**
- **Broader application scope for medium-sized projects**

BOSCH SECURITY SYSTEMS' Praesideo Version 3.0 includes new additional hardware such as an updated Network Controller, a Multi Channel Interface and Basic Amplifiers. These new devices will further enhance Praesideo's position in this competitive market by giving customers more flexibility in design and a more optimal and cost-effective solution. Praesideo is therefore ideal for medium-sized to big applications like shopping centers, educational establishments, offices, multi-purpose sports stadia and airports.

Network Controller

The updated Network Controller is equipped with a more powerful processor for even faster system response within very large systems. It also includes a 48 V DC battery back-up input.

Multi Channel Interface

The Multi Channel Interface is connected to the Praesideo optical system bus and acts as the interface to the system's Basic Amplifiers. It enables supervision of the unit itself and of the connected Basic Amplifiers, and also controls spare amplifier switching. The Multi Channel Interface has a built-in controller for digital multiple line and loudspeaker supervision, embedded on the existing loudspeaker lines. It controls 16 audio channels / outputs, including redundant group A/B switching or class-A loop wiring for the Praesideo Basic Amplifiers. Furthermore, the Multi Channel Interface provides connections for 32 control inputs and 16 control outputs.

Basic Amplifiers

The new Basic Amplifiers are rated 2 x 250 W and 1 x 500 W. They are high efficiency class-D amplifiers with built-in output transformers to drive 100 V and 70 V loudspeakers. They offer an analog audio line input for connection to the Multi Channel Interface as well as an additional analog line input for low priority local audio. They provide overload protected connections for separate group A and group B redundant loudspeakers in a zone and can be configured for class-A loudspeaker loop wiring. The Basic Amplifiers feature a switch mode power supply with low inrush current and operate both on mains and 48 V battery power. Power supply and amplifiers are fully supervised. Stand-alone operation is possible. Later this year the range will be extended with 4 x 125 W and 8 x 60 W versions.

The Standard Praesideo Amplifiers remain in the product range for applications, which demand Digital Signal Processing functionality such as delay, equalizing or automatic volume control.

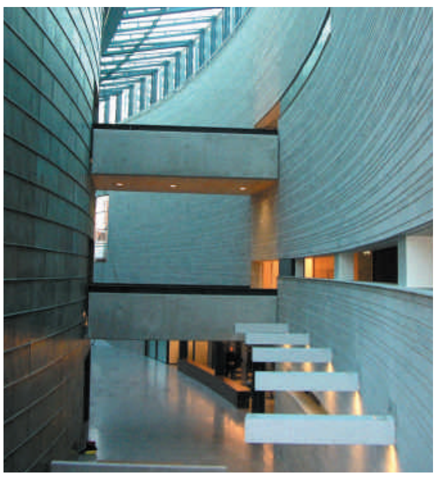
TÜV tested and approved

Praesideo Version 3.0 has been independently TÜV tested to EN/IEC60849 certification for "Sound Systems for Emergency Purposes". This means Bosch can assure not just installers but also fire departments, consultants/specifiers and end-users that the EVAC systems they are using comply with the strictest requirements of the EN60849 standard for public buildings.

Subjecting their products to this unique level of independent testing shows that Bosch Security Systems apply the strictest design criteria to provide PA and Emergency Voice Alarm systems that meet the highest industry standards for functionality, safety and quality.

See www.boschsecurity.com for further information

Estonia's New Art Museum installs Honeywell Analytics' Gas Detection System



Inside of the new KUMU building. High-resolution image available upon request

HONEYWELL ANALYTICS, the world's leading manufacturer of toxic and flammable gas and fire detection systems, has supplied a masterpiece of gas detection to the new main building of the Art Museum of Estonia, the Kumu Art Museum, in Tallinn.

Honeywell Analytics' Sensepoint gas detectors and Unipoint controllers being used to monitor for potential fire hazards, hang as an integral part of the building management system of the Kumu complex. The units are part of the cost-effective and easy-to-use Zareba range of fixed gas detection systems for industrial and commercial applications.

The Sensepoint flammable gas detector is equipped with the Honeywell Analytics' proprietary Surecell™ electrochemical sensing technology and poison-resistant catalytic beads. It has easily replaceable sensors and offers users a low cost solution to their gas monitoring needs, indoors or outdoors. The Unipoint DIN rail mounted controller enables users to easily expand and maintain the detection system without interrupting neighbouring devices. It can be installed into any plastic or metal enclosure for use indoor or outdoors and even in potentially explosive atmospheres.

The seven-storey Kumu building opened its doors to the public on February 18, 2006 and houses the largest permanent exhibition of Estonian art in the world with exhibition halls spanning 5,000m^2. The museum has over 55,000 art objects in its collection, of which 1,500 are on display at any one time, and meets all the international museum standards that enable it to bring valuable works to Estonia from abroad.

"This cultural, world-class project with The Art Museum of Estonia has been a great opportunity for Honeywell Analytics" says Chris Cottrell, vice president of sales and marketing.

"As one of the most spectacular museums in Europe, we are proud to be a part of this ambitious project."

For additional information, please visit www.honeywellanalytics.com
Email sales@zelana.com or call free on 00800 33322244 from Europe and Asia/ 1 800 538 0363 from the U.S.

Ameron Performance Coatings & Finishes

Ameron Performance Coatings & Finishes are world leaders in the development and supply of performance coatings to protect steel structures from fire and corrosion around the world. We work closely with the worlds leading architects and engineers to enhance the use and appearance of structural steel in the construction industry.

The development of Ameron's Steelguard® FM thin film intumescent coatings started in the mid 1980s, when the first companies started to market and develop intumescent coatings in the United Kingdom in cooperation with British Steel.

The company

The Ameron Performance Coatings & Finishes group is part of Ameron International which is a multinational company with a number of specialized companies producing and marketing highly engineered products for building, construction and industrial markets such as high performance coatings, fiberglass pipe and composites, concrete and steel pipe systems and other specialized construction products serving international companies around the world.

The products

Ameron B.V, Performance Coatings & Finishes in Europe is for more than 35 years a recognized supplier of protective coatings for the heavy industry and manufactures a broad line of high-performance coatings, floorings, surfacing systems and product finishes. Trade names include Amercoat®, Amershield®, Dimetcote®, the innovative PSX® Polysiloxane coating development and Steelguard® FM intumescent coatings.

These products are used in such diverse industries as oil and gas production, refining, petrochemical processing, fossil and nuclear power, marine, infrastructure maintenance, railroad, general manufacturing, pulp and paper, municipal water and waste treatment and original equipment manufacturing.

Thin film intumescent coatings

A thin film intumescent coating is the only passive fire protection method that enhances the visual appearance of a structure and will even add to the design with decorative finish and colour. This allows architects to show the steel construction while at the same time protecting its structural integrity in case of fire allowing safe evacuation and ensuring access time required for rescue workers.

Formulating the external grade intumescent Steelguard® FM550 and matching application innovations in the developing of off-site applied intumescent coatings demonstrates the proactive commitment from Ameron in solving the challenges of the construction industry.

Ameron offers a range of intumescent coating systems for various grades of fire protection, various weathering exposure conditions and application techniques while complying with many national and international legislations and standards.

For on-site application in closed buildings Ameron also markets specialized waterbased intumescent coating such as Steelguard® FM 580 and Steelguard® FM 585. These products can be combined with matching waterbased primer and finish coats and are used where buildings are repaired, refurbished or sometimes completely stripped and rebuild to allow a complete new usage of the construction.

Applications with Ameron's intumescent coatings

Constructions where Steelguard® FM intumescent coatings are used are for example shopping centres, warehouses, stadiums and airport terminals.

Typical constructions presently under development and coated with Ameron's Steelguard® FM are amongst others: Dubai International Airport, London Heathrow, Wembley National Stadium and Sofia Airport.

Cementitious fireproofing

In addition to the intumescent coatings Ameron also supplies a complete range of vermiculite cement fireproofing products under the trade name Steelguard CM. Specialized product versions are available for interior and exterior use providing protection to civil constructions but also in refineries, chemical plants and tunnels.

Service

Large projects frequently require additional fire engineering in which the coating supplier, designer and contractor develop solutions for specific project applications and construction solutions to meet all fire protection requirements. With an experienced coatings supplier like Ameron who is equipped with the latest laboratory facilities for formulating and fire testing, custom made solutions can be developed to ensure dependable and compliant fire protection.

Ameron products meet trends towards off-site painting of construction steelwork in high rise steel frame structures in city centres, minimising on-site painting in the construction and optimising the quality control procedures during the specialized application techniques. IFP

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PRODUCT PROFILE

Nittan NFD-68-P U.V. flame detector

As a general rule there are two main wavelength's which are monitored in order to manufacture cost effective flame detectors – Ultra-Violet (U.V.) and Infra-Red (I.R.) and these are located on either side of the visible light spectrum.

Ultra violet

The Nittan NFD-68-P U.V. flame detector operates in the U.V. region (185-260nm wavelength), using a U.V. Glass bulb type sensor, with a sensing range of about 40m and angular sensitivity of ±50°. It's inherent sensitivity is such that it can detect a 25mm flame at 5m.

The U.V. sensor used in the NFD-68-P, requires a supply voltage in the region of 350v DC. This voltage is generated inside the Flame detector, from the 10-30v dc supply.

The detector works on the pulse counting method, in that if less than 1 pulse/second is generated this is determined to be a non-alarm condition. If the pulse frequency increases (due to UV radiation striking the sensor), to greater than 30 pulses/second, or in the case of a very large fire (> 70 pulses in 1.5seconds), then an Alarm decision is made.

The detector incorporates signal processing circuitry and an on-board micro-controller, to reduce the possibilities of False Alarms, however it should be noted that although the U.V. sensor operates outside the wavelength(s) generated by direct sunlight, reflected light can be spectrally shifted into the sensitive band.

Infra red

The Nittan 2RA-P I.R. detector utilizes a combination of techniques and sensors, to detect Infrared emissions and make a decision as to the probability of a Fire being present.

1 *Pyro-electric effect*
The Pyro-electric element used for detecting Infrared wavelengths has a characteristic of self-polarization. When Infrared wavelengths impact on the Pyro-electric element, its state of polarization changes as its internal temperature changes, causing the electrical charges to become unbalanced.
These unbalanced electrical charges can be converted into a voltage change, thus, functioning as an Infra-Red sensor.
When treated with a Specific Band Pass Filter coating, each Pyro-electric sensor can be tuned to respond to a specific I.R. wavelength.

2 *CO_2 Resonant Emission*
A flaming fire emits a spectrum emission peak strength around the wavelength of 4.3μm (infrared zone). This is due to the discharge of large amounts of CO_2 gas in a fire. This phenomenon is called CO_2 resonant emission, which is one of the discriminating factors of flaming fires.

3 *Flicker Frequency*
The flame generated in the infrared zone during a fire has flickering movements of 1–10 Hz. The 2RA-P is set to respond only to flicker frequencies within this band.
The 2RA-P simultaneously monitors 2 wavelengths:
CO_2 resonant emission region (wavelength of around 4.3μm) and the non-fire-alarm discrimination wavelength region (wavelength around 4.0μm),
And declares a fire only if the following condition is reached:
An increase of signal level from the CO_2 resonant emission region and the signal level from the non-fire-alarm signal is lower than that of CO_2 resonant emission region.
i.e. The 1st wavelength Level > The 2nd wavelength: Fire Alarm.
Conversely, The 2nd wavelength > The 1st wavelength: Non-Fire Alarm, and continues to monitor.
The 2RA-P is capable of providing a supervision distance of 17m~30m and a supervision angle of ±50°.

Both the NFD-68-P and 2RA-P flame detectors are mechanically compatible with a standard Nittan detector mounting base, and a light-weight adjustable mounting bracket.

In addition, each product can be mounted into an ATEX approved Explosion Proof (Flame Proof) IP66 housing., for use in area's where there is a risk of un-intentional explosion of dust or gasses.

The UV housing uses Quartz glass (Spectrosil^{TM}), the IR housing uses Sapphire Glass as a viewing window material. It should be noted that these housings are NOT inter-changeable, since the Quartz glass will block frequencies in the IR band from reaching the sensor. IFP

NK

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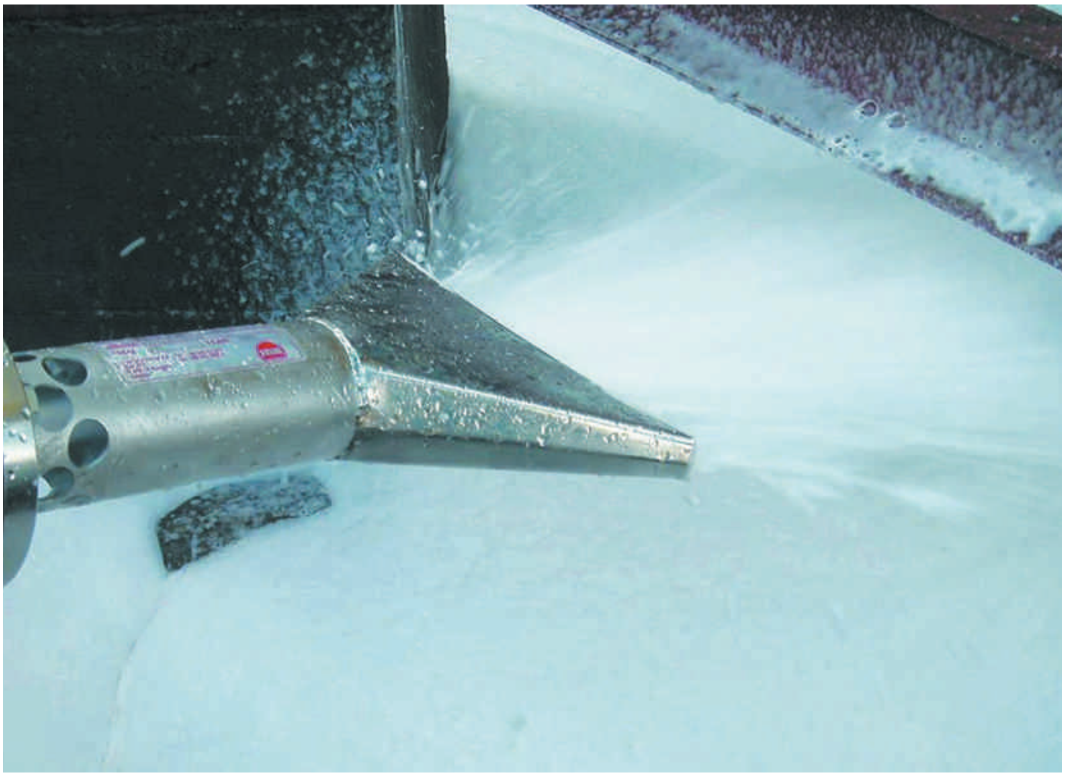

Fixed Foam Systems:

Selecting the Right Solution

Fixed foam systems are used throughout the world protecting onshore and offshore petrochemical facilities, cargo shipping, aircraft hangers, and a host of industrial manufacturing and storage applications, particularly those where highly volatile and highly flammable products such as fuel, plastics, paints and pharmaceuticals are stored. The loss of these high-cost business-critical assets, the threat to business continuity, the potential risk to life, and the impact on the environment means that swift and effective fire suppression is essential. So here, Peter Kristenson looks at the recent fixed foam system concentrate and hardware developments.

By Peter Kristenson

Product Manager for foam products at Tyco Fire and Security's Fire Suppression Group

A fire in any one of these areas poses serious problems, both for the firefighter and the facility owner or operator. And these headaches quickly turn into nightmare proportions the longer the fire burns. In many of these applications, where sometimes huge quantities of flammable materials are stored, a fire can soon – sometimes in minutes – become out of control. Fire extinguishing speed and efficiency are therefore absolutely vital.

Certainly, these are not risks that can be addressed using fire suppression solutions that rely solely on mobile deployment when an emergency occurs. Time is something that you do not have on your side, so wasting precious minutes marshalling equipment and human resources is a luxury you simply cannot afford. There really is no alternative in these situations to having the firefighting equipment in position and, in the vast majority of cases, this means having a fixed foam system permanently primed for immediate action and covering the entire area at risk.

This, of course, demands that fire risk assessments be undertaken by experienced professionals who have an intimate knowledge of the precise type of hazard that is being safeguarded, and the

particular characteristics of the site. It also essential to ensure that these risk assessments are kept up to date and are immediately reviewed when the nature of the risk changes in any way. This is because any fixed foam system is designed to fight a fire in a predetermined way and in predetermined circumstances and conditions. Change any of these conditions or circumstances without making corresponding changes to the fixed installation might well result in a compromised and less effective solution.

Enclosed industrial solutions

Fixed foam technology has been developed to a stage where there are now a number of solutions, each aimed at protecting a particular fire risk.

Until comparatively recently, the appropriate choices for protecting enclosed industrial applications were either high-expansion foam systems or low-expansion foam sprinkler systems. However,

Unfortunately, not all applications fall neatly into either the enclosed or exterior category. Aircraft hangers are a typical example. While they are "enclosed", they are invariably open-sided buildings, as in the case of the new Dubai Airwing Hanger.

the development of technology for producing Hi-Ex foam using smoke-contaminated air led to the advent of the HotFoam solution, which is increasingly being seen as the system of first choice for these "confined" applications.

Unfortunately, not all applications fall neatly into either the enclosed or exterior category. Aircraft hangers are a typical example. While they are "enclosed", they are invariably open-sided buildings, as in the case of the new Dubai Airwing Hanger – believed to be the world's largest aircraft

hangar – at the Dubai International Airport in the UAE, and the adjacent Emirates Engineering Centre hanger complex, where Tyco foam systems have recently been installed. The whole of one wall of the Airwing Hanger, for example, comprises eight sets of doors that are 26 metres high and span 570 metres wide, resulting in monitors being chosen in preference to a sprinkler system. At any one time, the Airwing Hanger can contain up to £2 billion worth of aircraft, so the ability to focus the monitors on the precise location of an outbreak was another factor in its favour.

External fixed foam systems

Externally, sprinkler system can be seriously challenged due to the effect of wind. Hence fixed foam oscillating monitors are frequently the most appropriate solution, especially since more powerful, remotely-controlled designs with long throw capability and fast knock-down have established themselves on the market. This is particularly so offshore and on exposed sites, where high gusting winds are frequent. In such instances, fixed monitors cost effectively protect bund and dike areas, jetties and truck loading racks and associated spill or ground fires.

Many monitors in the Skum range, for example, now incorporate features not readily found on other systems on the market, such as electric remote control rather than the more common reliance on hydraulic power. This enables a fire to

Within the onshore petrochemicals industry, the various designs of storage tanks – cone roof tanks, open-top floating roof tanks, covered floating roof tanks, and horizontal tanks – have led to the development of a number of sophisticated fixed foam delivery solutions.

be fought effectively from a greater distance, so significantly reducing the risk to firefighters' lives. Skum monitors also utilise materials such as stainless steel and bronze that are more resistant to corrosion in harsh industrial environments.

A typical example is the jetty protection system recently installed at the Neste petrochemicals plant in Porvo, Finland. Here Tyco supplied a Skum full jetty protection system to bring the facility up to the highest international safety and environmental standards. The installation included remotely-controlled and manually operated monitors that are positioned on 11-metre high towers to enable the system to fight fires on the jetty itself and the deck of any vessels loading or unloading oil. A particular feature of the installation is that all of the equipment was specially designed and manufactured to operate at temperatures as low as –35°C.

Within the onshore petrochemicals industry, the various designs of storage tanks – cone roof tanks, open-top floating roof tanks, covered floating roof tanks, and horizontal tanks – have led to the development of a number of sophisticated fixed foam delivery solutions. These include the semi-sub-surface system, of which the Skum system was the first of its kind on the market, the sub-surface system, and the over-the-top system.

Hotfoam enclosed hazardous area protection

Skum's HotFoam operates on very different principles to conventional Hi-Ex systems. With HotFoam, the foam generators do not require power in any form and are located inside the protected space, using the air and smoke from the fire itself to generate foam bubbles. This does away with the need for an external fresh air supply for foam production, and provides the flexibility and effectiveness often required for warehouse protection.

In addition, the rapid knock-down of the flames and heat helps to minimise damage to the building structure and its contents. HotFoam can be effectively used on both hydrocarbon and polar solvent liquids, as well as solid combustibles, such as rubber, plastic, wood, paper and chemicals.

Typical applications for HotFoam are enclosed hazardous areas, such as chemical and petrochemical processing plants, warehouses, and flammable material production facilities. Other applications include tunnels – including cable tunnels, vehicle and rail tunnels – transformer stations and any spaces where an efficient fire fighting system is required that utilises a minimum amount of water.

The foam station for a HotFoam system comprises: a water source; water pump; foam proportioner; Skum's Meteor P foam concentrate; a foam concentrate tank; the HotFoam control system; valves; fittings, piping and the HotFoam generators. As with conventional Hi-Ex foams, HotFoam provides quick and effective extinguishing of a fire and has low water consumption.

A HotFoam installation requires minimal maintenance. Air ducts, wall openings and additional smoke ventilation is not called for, pipe positioning is simplified, a pump with only a small capacity is needed, and there is considerable flexibility regarding the positioning of the HotFoam foam generators. Other benefits include simplified installation – since the low-weight generators can be hung directly in the supply pipes – simultaneous foam production over the entire protected area, and reduced emissions of smoke gases.

Petrochemical tank protection

Foam generators used in fixed systems have proved very successful in many petrochemical tank farm installations. However, any damage to the tank structure may well limit the foam generator's efficiency. This, together with maintenance issues, has lead to the widespread use of sub-surface injection systems, where sufficient water pressure is available for their use.

Sub-surface injection of foam into a storage tank is, as the name implies, where the foam is injected into the bottom of a tank, and then floats to the surface to spread and extinguish a fire. However, this method is unsuitable for use with polar solvents, even where alcohol-resistant concentrates are used, because the fuel destroys the foam. So extreme care must be taken to ensure that the sub-surface injection technique is not used where potential risks contain alcohol or other polar solvent additives as oxygenates.

Fixed low or medium expansion generators can be used to create an effective foam blanket, even on larger bund areas in major tank farms, and any residual fuel in the tank can be protected using a monitor. In reality, monitors can be used to protect the bund area, but this results in much higher foam consumption.

Sub-surface injection also cannot be used on cone roof tanks with internal floaters, in accordance with the NFPA 11 standard for low, medium and high-expansion foams. To overcome this problem, the so-called semi-subsurface injection technique has all of the benefits of sub-surface injection, and can be used for all types of fuel. The semi-subsurface technique uses a flexible hose that floats to the surface when the system is activated, to deliver the foam to the surface.

Fixed systems can be used for floating roof tanks; foam pourers are used to protect the rim seal area, with the foam being contained by a dam. However, good foam fluidity is essential to ensure that rapid coverage is achieved, and some oil companies have adopted a belt-and-braces approach and installed both foam pourers and sub-surface systems on covered floating roof tanks.

Horizontal tanks have been known to rupture following an explosion, so it is necessary to ensure that the bund area is adequately protected. Fixed low or medium expansion generators can be used to create an effective foam blanket, even on larger bund areas in major tank farms, and any residual fuel in the tank can be protected using a monitor. In reality, monitors can be used to protect the bund area, but this results in much higher foam consumption. At least two monitors are recommended to protect larger bunds to ensure full coverage and access to devices under all wind conditions.

New foam for petrochemical applications

The success of a fixed foam firefighting system is, of course, as much reliant upon the correct choice of foam as it is the delivery system.

There have, in recent years, been many advances in the field of foam concentrates. Today, they range from the low cost but highly stable protein foams, through to the latest leading-edge synthetic products, such as Tyco's Ansul-brand Thunderstorm 1 x 3, which was developed in consultation with Williams Fire and Hazard Control Inc, probably the world's most highly respected specialist in the fire protection of flammable liquids.

Thunderstorm is a new generation of alcohol resistant AFFF concentrate. Specifically designed to fight fires in oil refineries, it uses new technology

and has a dramatically reduced viscosity when compared with other 1 x 3-listed polar-solvent type AFFF concentrates on the market. This enhances the foam's performance in all types of foam proportioning equipment, including in-line eductors and balanced pressure systems.

The new foam can be used as a three percent solution on fires involving polar solvents, such as acetone, methanol and methyl ethyl ketone, and a one percent ratio on fires involving hydrocarbons such as high-octane petrol, aviation fuel and naphtha. These are the two most common types of flammable liquid fire that can occur in an oil refinery, and these low ratios simplify foam storage and dispersement around the site, and greatly increases the "staying power" of fixed foam firefighting systems.

Strategic foam stocks

Another area that impacts on the success or otherwise of fixed foam firefighting systems is the ready availability of a suitable foam concentrate. This is why Tyco is providing emergency support to the petrochemicals industry in the form of strategically located stocks of foam concentrate that are sufficient to meet any eventuality. It is a capability that has already been put to the test, when recently foam was supplied within a matter of hours for two separate tank farm emergencies in northern Europe.

In practice, these foam stocks are constantly being relocated as and when it is necessary to reflect local supply and availability conditions, and requires working closely with customers, particularly when they are updating their risk assessments and contingency plans for each site. IFP

STRAIGHT TALK ABOUT DUPONT™ FORAFAC®

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Carbon dioxide measures up as a real hazard

By Robert Henderson

Vice President, Business Development BW Technologies by Honeywell

Carbon dioxide is one of the most frequently overlooked of all toxic gases. Even to refer to CO_2 as a toxic gas is a surprise to many safety professionals.

Carbon dioxide is the fourth most common gas present in the earth's atmosphere, with an average ambient concentration (in fresh air) of about 350 ppm. Carbon dioxide is one of the most common byproducts of living organisms. With every exhaled breath we produce and release CO_2 into the atmosphere (with an average concentration in exhaled breath of about 3.8%). According to one USDA study, an average person produces about 450 liters (900 grams) of CO_2 per day.

Liquid and solid carbon dioxide (dry ice) are widely used as refrigerants, especially in the food industry. Carbon dioxide is also used in many industrial and chemical industry processes. Carbon dioxide is particularly associated with the beer and wine making industries, where it is produced as a byproduct of fermentation. Carbon dioxide is also widely used in the oil industry, where it is commonly injected into oil wells to aid the decrease the viscosity and aid in the extraction of oil from mature fields. It is also one of the most common atmospheric hazards encountered in confined spaces.

Carbon dioxide is a primary byproduct of bacterial decomposition. As with people, "aerobic" or oxygen using bacteria produce carbon dioxide as a primary metabolic byproduct. In many confined spaces there is a direct relationship between low concentrations of oxygen and elevated concentrations of CO_2. In the case of a confined space where CO_2 is generated as a byproduct of aerobic bacterial action, a concentration of 19.5% O_2 (the hazardous condition threshold for oxygen deficiency in most jurisdictions) would be associated with an equivalent concentration of at least 1.4% (= 14,000 ppm) CO_2. This is substantially higher than the workplace exposure limit for CO_2 in most jurisdictions (5,000 ppm calculated as an 8-hour TWA).

The true concentration of CO_2 could be substantially higher if the oxygen deficiency is due to displacement rather than consumption of the oxygen in the confined space. Fresh air contains only 20.9% oxygen by volume. The balance consists mostly of nitrogen, with minor or trace concentrations of a wide variety of other gases including argon, water vapor and carbon dioxide. Because oxygen represents only about one-fifth of the total volume of fresh air, every 5% of a displacing gas that is introduced into a confined space reduces the oxygen concentration by only 1%. As an example, consider an oxygen deficiency due to the introduction of dry ice into an enclosed space. In this case a reading of 19.5% O2 would not be indicative of 1.4% CO_2, it would be indicative of 5 x 1.4% = 7.0% (= 70,000 ppm) CO_2.

The bottom line is that if you wait until the oxygen deficiency alarm is activated, and the deficiency is due to the presence of CO_2, you will have substantially exceeded the toxic exposure limit before leaving the affected area.

In spite of these considerations, in the past the majority of atmospheric monitoring programs have treated CO_2 as only a "simple asphyxiant". An asphyxiant is a substance that can cause unconsciousness or death by suffocation (asphyxiation). Asphyxiants which have no other health effects are referred to as "simple" asphyxiants. Because CO_2 was not considered to be a toxic hazard, rather than directly measuring the CO_2 in the confined space or workplace environment, it was seen as adequate to simply measure the oxygen concentration. This attitude is changing as it becomes more feasible to directly measure CO_2 concentration by means of compact, portable multi-sensor gas detectors equipped with miniaturized infrared sensors for the direct measurement of this gas.

Carbon dioxide is a toxic contaminant with strictly defined workplace exposure limits

Carbon dioxide is listed as a toxic contaminant with strictly defined occupational exposure limits in almost every jurisdiction. The most widely recognized exposure limits for CO_2 reference an 8-hour TWA of 5,000 ppm, with a 15-minute STEL of either 15,000 ppm or 30,000 ppm. The table lists several of the most commonly cited workplace exposure limits.

Carbon dioxide is heavier than air, with a

Standard/Country	8-hour Time Weighted Average	15-minute Short Term Exposure Limit
United Kingdom WEL	5,000 ppm	15,000 ppm
USA NIOSH REL	5,000 ppm	30,000 ppm
USA OSHA PEL	5,000 ppm	None Listed
ACGIH® TLV®	5,000 ppm	30,000 ppm

density of 1.5 times that of fresh air. While present as a natural component in fresh air, at higher concentrations exposure symptoms include headaches, dizziness, shortness of breath, nausea, rapid or irregular pulse and depression of the central nervous system. Besides displacing the oxygen in fresh air, high concentrations of CO_2 may exacerbate or worsen the symptoms related to oxygen deficiency, and interfere with successful resuscitation.

Concentrations of 40,000 ppm or higher should be regarded as immediately dangerous to life and health. Exposure to very high concentrations (e.g. exposure to 6% volume CO_2 for several minutes or 30% volume CO_2 for 20-30 seconds), has been linked to permanent heart damage, as evidenced by altered electrocardiograms. Concentrations greater than 10% are capable of causing loss of consciousness within 15 minutes or less.

How NDIR (non-dispersive infrared) CO_2 sensors detect gas

The most widely used technique for real-time measurement of carbon dioxide is by means of non-dispersive infrared (NDIR) sensors that measure CO_2 as a function of the absorbance of infrared light at a specific wavelength.

Molecules can be conceptualized as balls (atoms) held together by flexible springs (bonds) that can vibrate (stretch, bend or rotate) in three dimensions. Each molecule has certain fixed modes in which this vibratory motion can occur. Vibrational modes are dictated by the nature of the specific bonds that hold the molecule together. The larger the molecule, the greater the number of modes of movement. Each mode represents vibrational motion at a specific frequency. The modes are always the same for a specific molecule. Chemical bonds absorb infra-red radiation. The bond continues to vibrate at the same frequency but with greater amplitude after the transfer of energy. For infrared energy to be absorbed (that is, for vibrational energy to be transferred to the molecule), the frequency must match the frequency of the mode of vibration.

Specific molecules absorb infrared radiation at precise wavelengths. When infrared radiation passes through a sensing chamber containing a specific contaminant, only those wavelengths that match one of the vibration modes are absorbed. The rest of the light is transmitted through the chamber without hindrance. The presence of a particular chemical group within a molecule thus gives rise to characteristic absorption bands. Since most chemical compounds absorb at a number of different frequencies, IR absorbance can provide a "fingerprint" for use in identification of unknown contaminants. Alternatively, for some molecules it may be possible to find an absorbance peak at a specific wavelength that is not shared by other molecules likely to be present. In this case absorbance at that particular wavelength can be used to provide substance-specific measurement for a specific molecule. Carbon dioxide has such an absorbance peak at a wavelength of 4.3 microns (m^2). Absorbance of infrared light at this wavelength is directly proportional to the concentration of CO_2 present in the sensing chamber of the sensor.

Miniaturized NDIR CO_2 sensors include an infrared light source (typically a tungsten filament lamp) capable of emitting light in the desired

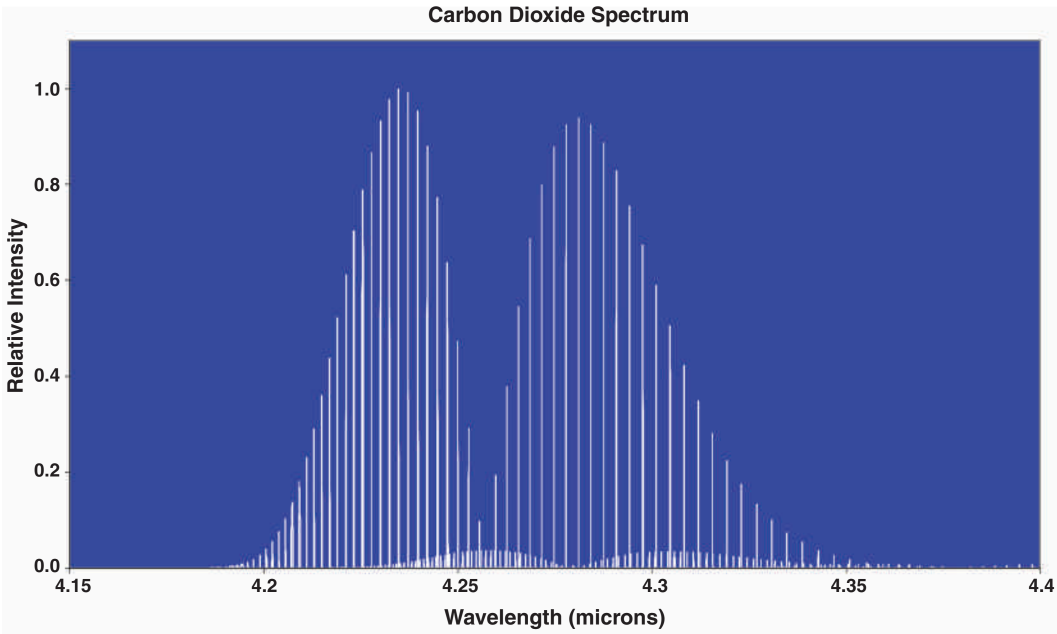
Miniaturized NDIR sensors directly measure CO_2 by means of absorbance of infrared light

wavelengths. Optical filters are used to limit the light transmitted through the sensing chamber to a narrow range of wavelengths. Pyroelectric detectors capable of measuring absorbance at the specific wavelength of interest are used to provide the measurement signal. Most NDIR CO_2 sensors are dual detector systems that provide both a reference and an active signal. The amount of light that reaches the active detector is proportional to the concentration of CO_2 present in the sensing chamber. The greater the concentration of CO_2, the greater the reduction in the amount of light that reaches the detector when compared to the reference signal.

In the past, infrared based instruments have tended to bulky, expensive and required a high level of operator expertise to obtain accurate readings. A new generation of miniaturized NDIR sensors has permitted the development of infrared based instruments for an ever widening variety of contaminants including carbon dioxide, "Freons", ammonia, and methane, as well as generalized hydrocarbon combustible gas detection.

The regulations are already changing. Recent fatalities in the wine industry in California have heightened concerns, and increased the obligation for direct CO_2 measurement during workplace procedures that may expose workers to this contaminant. In Germany and Austria regulations already require direct measurement of CO_2 during most confined space entry procedures. It is clear that with the increased availability, and increasingly affordable cost of miniaturized NDIR CO_2 sensors, more and more atmospheric monitoring programs will include the direct measurement of this dangerous atmospheric contaminant. IFP

Robert Henderson is Vice President, Business Development for BW Technologies by Honeywell. Mr. Henderson has been a member of the American Industrial Hygiene Association since 1992. He is the 2006 Chairman of the AIHA Gas and Vapor Detection Systems Technical Committee as well as a current member and past chair of the AIHA Confined Spaces Committee. He is also a past chair of the Instrument Products Group of the Industrial Safety Equipment Association.



The infrared absorbance spectrum of carbon dioxide shows a strong peak at 4.3m^2

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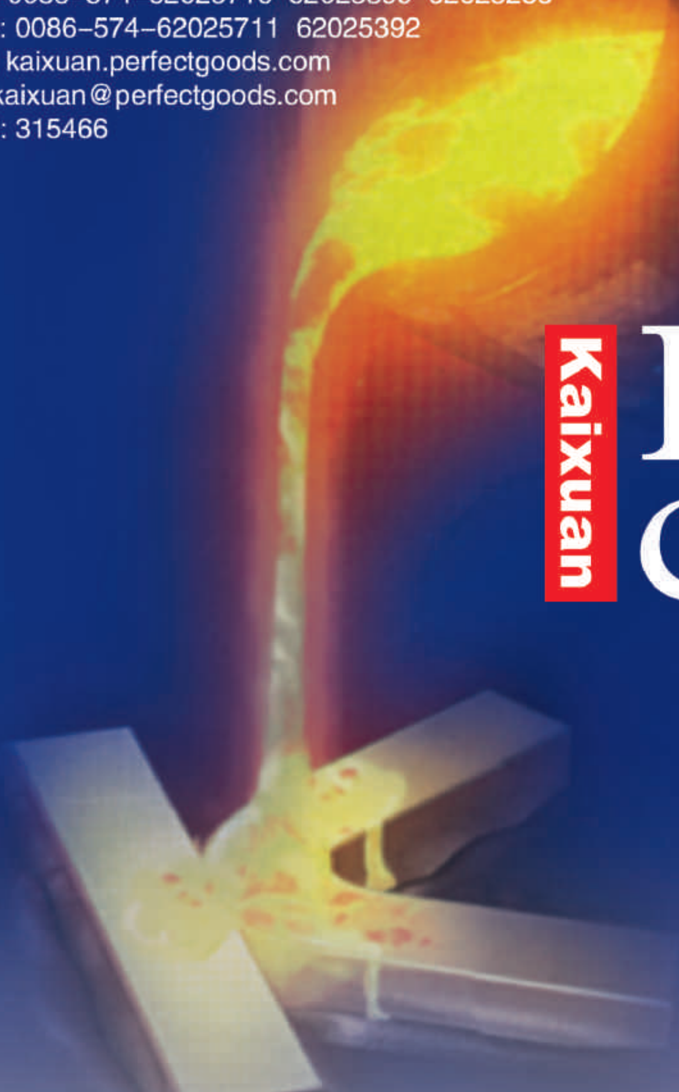

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tyco Fire & Security

Platform Fire:

The oil companies' worst nightmare

Few locations present greater fire suppression challenges than oil platforms. Well beyond the immediate reach of outside help, at the mercy of a virtually limitless supply of highly inflammable liquid, and no easy escape for the platform workers, they demand suppression systems that define the word robust, and set the standard for fast and efficient fire suppression. Andrew Shiner explains.

By Andrew Shiner

Director of Marketing, Europe, the Middle East and Africa, Tyco Fire & Security's Fire Suppression Group

Oil platform workers are probably among the best trained of any industry when it comes to fire safety. Oil companies are to be commended for the way in which commercial competition is put aside where fire safety issues are concerned, as is evidenced by the work of such organisations as the UK's JOIFF [Joint Oil and Industry Fire Federation]. Oil platforms are constructed with meticulous care and attention being paid to the fire safety implications. However, oil platform fires do occur, and when they do, suppression systems are tested to the limit.

Firefighting systems on oil platforms have to withstand the rigours of a hostile and corrosive environment, they must be easy to maintain, and respond quickly to rapidly developing fires that typically have high heat release rates. They must also have a high degree of reliability, as any second line of firefighting defence is not likely to make a meaningful impact before the blaze has developed far into the life and asset threatening phase. Putting it as simply as possible, there is no scope for containing the fire until the arrival of trained firefighters.

An oil rig fire potentially involves uncontrolled hydrocarbon release; firefighting efforts are entirely in the hands of the rig's workforce, and evacuation brings to mind the expression "caught between the devil and the deep blue sea", particularly if the incident has resulted in oil spillage into the surrounding water.

For the purposes of firefighting, rigs can be divided into two areas. These are what might best be described as the production areas – the off loading, drilling, and wellhead areas, plus the platform helicopter pad – and the control facilities. With the ready availability of seawater, deluge systems were frequently used to protect certain of the production facilities, however fixed and mobile foam firefighting techniques are fast becoming more commonplace as a quicker and more effective means of suppressing a hydrocarbon fire in

the often unpredictable weather conditions experienced at sea. Control facilities on oil rigs are now invariably safeguarded using a gaseous suppression system.

Petrochemical firefighting foam solutions

The effectiveness of a foam firefighting system is dependent upon two elements: the foam concentrate and the delivery system.

AFFF [Aqueous Film Forming Foams] have been used on oil rigs for many years, as they meet the industry's quality standards, can be used with a wide range of equipment, and have an acceptable shelf life. However, it is only recently that an AFFF has been specifically developed for the petrochemicals industry.

This new foam is the result of the teaming-up of Ansul with Williams Fire and Hazard Control Inc, probably the world's most highly respected specialist in the fire protection of flammable gases and liquids. Thunderstorm ATC 1 x 3, a new generation of alcohol resistant AFFF foam concentrate. It is specifically designed to fight oil fires, uses new technology, and has a dramatically reduced viscosity when compared with other 1 x 3-listed polar-solvent type AFFF concentrates on the market. This enhances the foam's performance in all types of foam proportioning equipment, including in-line eductors and balanced pressure systems.

Thunderstorm is used as a one percent ratio for hydrocarbon fires and three percent for polar solvent fires, which simplifies foam storage and greatly increases the "staying power" of both fixed firefighting foam systems and mobile monitors. It extinguishes an oil fire in three ways. First, it creates an aqueous film that forms a barrier to help prevent the release of fuel vapour. Second, it

forms a blanket that excludes oxygen and from which the liquids that form the film or membrane drain. Third, the water content of the foam produces a cooling effect.

Thunderstorm can be used with salt water and is formulated from special fluorochemical and hydrocarbon surfactants, high molecular weight polymers and solvents, and can be transported and stored as a concentrate. This ensures ease of use and considerable savings in weight and volume. Typically, aspirating discharge devices produce expansion ratios of between 5:1 and 10:1, while non-aspirating devices such as hand-line water fog/stream nozzles or standard sprinkler heads are between 2:1 and 4:1. Medium expansion discharge devices produce ratios of between 20:1 and 60:1, depending on the type of device and the operating conditions.

Proven foam delivery systems

There are also a number of foam systems that are specifically designed for fighting oil platform fires, an example of which is the Skum Helideck fire-fighting System.

This system can be adapted to suit the dimensions and layout of the helicopter landing deck. The major components of a typical installation are a displacement pressure proportioner with a foam concentrate tank – more commonly referred to as a bladder tank – and two foam monitors, one placed on either side of the helideck. While the bladder tank offers the advantage of combining a storage facility for the foam concentrate with a proportioning device, it is also completely independent of external power sources and has very few moving parts.

Water under pressure is all that is required to operate the system, and the measuring orifice can be placed at any convenient location between the bladder tank and the monitors. In many cases this is a 600-litre MTB bladder tank/ automatic proportioner and two Skum foam monitors, each with a capacity of 2,500 litres a minute. Skum monitors are available in a range of capacities, are manufactured to the most exacting standards and are designed to work with AFFF concentrates and offer the benefits of compact design, low weight and low pressure loss.

Gaseous protection for oil rig control centres

Until comparatively recently, control centres on oil rigs were protected by Halon 1301 systems. They were fast acting and efficient. However, with the demise of Halon 1301 following the signing of the Montreal Protocol, the offshore industry has been seeking an alternative that fulfilled its need for fast response and effectiveness in occupied areas, ideally without any adverse impact on the environment, which many oil companies are now concerned to avoid. Sustainability has, for some time, been on the oil companies' agenda.

The aim of many companies was to find a solution that does not have the unacceptably high global warming potential that characterises many of the Halon alternatives that came onto the market following the demise of Halon. The solution that an increasing number are adopting is the Sapphire fire suppression system that was launched towards the end of 2004. It is a truly sustainable, environmentally acceptable and long-term alternative to Halon 1301 that utilises 3M's Novec 1230 fluid, and has several major advantages over other Halon alternatives or extinguishants.

Sapphire installations are designed to protect essential and delicate telecommunications, data processing and process control equipment. They have a footprint similar to that of chemically-based clean agent systems and Novec 1230 fluid has the lowest level of design concentration and the highest safety margin of any viable Halon 1301 or chemical alternative. The suppressant also has an impressive "environmental footprint", with zero ozone depleting potential and a remarkably low atmospheric lifetime of just five days, so does not have any appreciable impact on climate change. This five-day lifetime compares with an atmospheric life for Halon 1301 of a staggering 107 years.

Typical total flooding applications use between just four and six percent by volume of the fluid, which is well below the agent's saturation or condensation level. When discharged, the agent is dispersed through natural ventilation, leaving no residue to damage sensitive electronic equipment; it is also non-conductive and non-corrosive.

The fluid has a global warming potential of just one. This contrasts with a not untypical HFC – that, incidentally has an atmospheric lifetime of 36 years, against the fluid's five days – where for the release of just one kilogramme of the HFC, 2,800 kilograms of the Novec 1230 fluid would have to be released to have the same impact on climate change. Significantly for its long-term viability, Novec 1230 fluid is not included in the basket of greenhouse gases identified by the Kyoto Protocol.

The fluid is stored in cylinders as a low vapour pressure fluid that transmutes into a colourless and odourless gas when discharged. Unlike other fluid fire extinguishing agents, it can be used with absolute confidence to suppress fires involving electronic, computing or communications equipment. While certain HFCs and inert gases are used at design concentrations that are below the NOAEL [No Observed Adverse Effect Level], with safety margins that range from seven percent to 20 percent, no other Halon alternative comes anywhere close to Sapphire's 92 percent safety margin.

Typical total flooding applications use between just four and six percent by volume of the fluid, which is well below the agent's saturation or condensation level. When discharged, the agent is dispersed through natural ventilation, leaving no residue to damage sensitive electronic equipment; it is also non-conductive and non-corrosive.

Inert gas protection

From the oil companies' marketing campaigns it is clear that many are committed to reflecting a more environmentally-concerned image and are investing heavily in environmental initiatives.

This has filtered down to a concern regarding the environmental credentials of the products and systems used on oil rigs and has led to a growing interest in the use of inert gas fire suppression systems that are non-toxic, non-corrosive and odour-free, zero ozone depleting and with zero global warming potential. The result is an increase in the use of the new Hygood i3 inert gas to protect control rooms on oil rigs.

Among its many benefits, i3 is fast acting and has a low life-cycle cost; it is electrically non-conductive and has no breakdown products or residue, so there is no risk of damage to sensitive electronic equipment, plus i3 has zero impact on the environment. Significantly, where space is at a premium, i3 has a smaller footprint than traditional lower-pressure inert gas technology.

i3 is a pure 50:50 mixture of two naturally occurring gases – Argon and Nitrogen – and so appeals to the oil industry. The blended gases have a similar density to air, so the mixture retains its concentration when discharged for far longer than the now outlawed Halon 1301 chemical suppressant.

It extinguishes a fire on discharge by reducing the ambient concentration level of oxygen to between 10 percent and 14 percent. This is below the concentration level necessary to support combustion, but sufficient to support life for a short period. Hence, i3 is ideal for use in occupied oil rig control centres. Its appeal for use in occupied spaces is further enhanced by its being an invisible gas that does not obscure vision.

Hygood i3 is stored in high-pressure steel containers with an operating pressure of 300bar. Installations comprise one or more containers connected to a system of pipework and rapid-discharge nozzles; fully engineered solutions designed using i3 flow calculation software. Cylinders can be stored remote from the area being protected and a bank of cylinders can be used to safeguard more than a single room or enclosure.

It has long been recognised that, while the incidence for fires on oil rigs is, thankfully, relatively low, the potential for loss in life and the destruction of business critical assets is alarmingly high, perhaps more so than in any other industry It is necessary only to recall the Piper Alpha oil rig fire in the North Sea in 1988 when 167 people were killed and a rig was destroyed to understand why.

However, fire safety technology and an understanding of the importance or risk assessments and the implementation of soundly thought out fire safety strategies has made major strides in the intervening 18 years, and tried-and-tested solutions are now available that safeguard both the corporate assets and the lives of those who work in what by any definition is a potentially dangerous environment. IFP


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VSD System protects world's largest hangar

The world's largest aircraft hangar, the massive new Royal Airwing Hangar complex at the Dubai International Airport in the UAE, is now home to the Dubai ruling family's private aircraft. It is protected by a D-Tec FM [Factory Mutual] approved video smoke detection system that Malcolm Gatenby, a director of BSS-ME, D-Tec's distributor in the Middle East, describes here as offering the fastest and most reliable fire detection.

By Malcolm Gatenby

A director of BSS-ME

The huge open-span, eight-bay Royal Airwing Hangar is 600 metres wide and 110 metres deep, and will hold up to eight aircraft with a total value that industry experts say may well exceed £2 billion. This includes the 79.8-metre wingspan Airbus A380, the world's largest passenger aircraft. At the front, the hangar has eight sets of doors that span 584 metres, each of which is 25.8 metres high. At the front of the hangar, the floor-to ceiling height is 30 metres to accommodate the aircrafts' tailplane; this height tapers to 25 metres at the rear.

Initially, linear heat cables in the open roof void were specified as the primary means of fire detection. However, serious shortcomings were soon highlighted, primarily in relation to the hangar's height and the time that would be taken before the linear heat detectors were activated.

Consultants and Fire officers responsible for the building were concerned that serious damage to the parked aircraft would have already resulted by the time delay before either the smoke or heat would have reached the detectors. Even then, there has to be a sufficient build up of smoke concentration to activate the detector. Aspirating smoke detection systems that draw sampled air into the detector are similarly challenged in high ceiling height structures as, again, smoke still has to reach the sampling position in the roof before the alarm is activated.

The inadequacy of these systems in voluminous buildings such as the Royal Airwing Hangar is further exacerbated by the high ceiling height and the possibility of smoke stratification further

delaying the activation of the conventional detectors at ceiling level. Smoke rises because it is hotter than the surrounding air and, as it travels through the cooler air, it cools down. Once the smoke reaches the same temperature as the air, which in Dubai can reach as high as 40°C, it stops rising and will not be detected until the heat generated by the growing fire raises the stratification level. Indeed, the thermal barrier created by the high ambient temperature air rising to the hangar's ceiling, creating a hot air barrier, will only make early detection by traditional detectors less likely.

Another consideration that encouraged the hangar's consultants and fire officers to seek a faster and more reliable solution was the fact that the hangar's huge doors would be open for most of the time. This means that there would be no reliably predictable airflow route, leading them to the conclusion that the only dependable solution was to seek an "at source" detection system. A visit to a D-Tec protected British Airway's hangar at Heathrow Airport in London persuaded them that the best solution was the D-Tec's FM-approved VSD, or video smoke detection system.

The at-source detection option

VSD was originally developed in the late 1990s as a reliable early warning fire detection solution for nuclear-powered turbine halls. Briefly, it works by sophisticated computer analysis of video images provided by standard CCTV cameras – often existing CCTV security installations. Using advanced image processing technology and extensive detection and known false-alarm phenomena algorithms, VSD automatically identifies the distinct characteristics and particular motion pattern of smoke and alerts the system operator to its presence in the shortest possible time.

Because VSD is constantly looking at the source of the smoke, it does not rely on the proximity of smoke to the detector, so its effectiveness is not adversely affected by distance – a common failing with systems that rely on the smoke finding the detector. The D-Tec system rapidly detects smoke by seeking small areas of change within an image. These pixel changes are then passed through a series of filters that seek the particular characteristics that are known to be associated with smoke behaviour.

Although it is claimed that other camera-based systems are able to detect smoke, these are really motion detectors or obscuration-change detectors that are unable to differentiate between smoke and other sources of movement and so are prone to false alarms. By comparison, D-Tec's VSD is so accurate that it can distinguish between smoke and steam. So, the uniqueness of D-Tec's VSD is its intelligence; its ability to accurately detect smoke patterns at-source, and differentiate between them and other movement patterns.

At system installation, there is the option to vary the amount of the smoke signal and the length of time that the smoke is present before alarm conditions are met. This is to accommodate conditions where smoke, such as might be generated by welding equipment, may be present as part of the production or maintenance process. The video image can also be divided into zones, and the system programmed to raise the alarm only if smoke or flames are present in two or more zones. There is also the option of "linking" two cameras so that smoke or flame detected in one camera's image is treated as a pre-alarm, while smoke or flame detected by both cameras activates a full alarm.

The system can also be configured to compensate for areas within the cameras' field of vision that could, potentially, distort smoke or flame identification, such as windows, highly reflective surfaces and smoke producing processes. This is achieved by masking-off parts of the image on a pixel-by-pixel basis.

The VSD system can process real-time video information simultaneously from up to eight cameras. The system does not multiplex the images, so information is neither lost nor delayed,

and all alarm condition images are date and time logged and stored within the system's memory.

Airwing solution

The solution for the Royal Airwing Hangar was devised by BSS-ME in Dubai, working closely with engineers from D-Tec in the UK. The VSD equipment was supplied to Honeywell, which provided the CCTV equipment, and the installation was carried out by BK Gulf's BCL Fire Systems division, part of the Dutco Balfour Beatty Group.

It comprised a combination of infrared flame detection and D-Tec's VSD system. The flame detectors are fitted below wing height, while the VSD CCTV cameras are installed around the perimeter of the hangar, 15 metres above floor level, just above the planes' wing height. This ensures that the VSD system will detect smoke escaping from any aircraft doors or appearing above wing level from a fire lower down. The systems are linked together so that, should one or both detect smoke or flame, the alarm is automatically triggered and the hangar's Tyco Suppression Systems' foam extinguishing system is activated.

Eight CCTV cameras are used to protect each of the eight areas of the hangar, resulting in a total of 64 cameras. Each eight-camera area is individually wired to one VSD 8 unit, and four areas – or 32 cameras – are connected to one of two 48U rack-mounted systems. Each camera has a 40-degree field-of-view and is located no further than 60 metres from the furthest detection point.

The two VSD 48U rack-mounted units are located in a central manned control room, and each rack consists of an integral monitor, keyboard and mouse.

Airport expertise

The Royal Airwing Hangar in Dubai is not the first D-Tec VSD installation designed and completed by BSS-ME in a major Middle East airport. An installation was recently completed at Oman's Royal Hangar at Seeb International Airport. Here too the airport authority had originally planned to install flame and linear heat cables in the 210-metre by 110-metre by 27-metre high hangar. That was until, in 20 tests, the VSD system detected smoke that appeared above the planes' wings within 90 seconds, proving that it does not wait for smoke to rise to the roof.

Like the Royal Airwing Hangar in Dubai, the Royal Hangar at Seeb International Airport was built to house the A380 Airbus and the Boeing 747. It too was designed to have no internal support columns.

Distributed remote control

While not part of either the Royal Airwing Hangar project or the Royal Hangar at Seeb International Airport, the latest development of D-Tec's VSD technology represents a major step forward in terms of airport fire safety management.

D-Tec's recently launched NetVu Connected FireVu video smoke detection uses the same proven detection technology as the VSD-8 system used in Dubai and Oman. However, it advances VSD from being a system that is limited to being monitored on local site-based computers, to one where the alarm, including the video images, can be distributed to an unlimited number of remote control centres.

This means that any number of hangars, maintenance workshops and unmanned facilities on an airport can be monitored remotely from one or more control centres. In fact, the control centre does not have to be on the same site, or even in the same country.

FireVu utilises the latest secure communications technology and applies it to the proven VSD platform. This takes sophisticated, accurate and high-speed smoke, flame, or combined smoke and flame detection to a greater level of versatility, integration, cost effectiveness and responsiveness. The new TCP/IP [Transmission Control Protocol/Internet Protocol]-based VSD system is easier to use and maintain than the VSD-8 system, plus it allows smoke detection to be more comprehensively integrated with security and facilities management systems.

As it uses TCP/IP as the communications backbone, FireVu also allows easier and faster monitoring and diagnosis of installations, and hence the quicker resolution of any maintenance issues. Reconfiguring a FireVu system – when, for example, changes have been made to the facility being protected – can be carried out remotely, removing the cost and delay associated with travelling to the site. The same applies should a system fault arise.

All of the alarm events are recorded on the system's DVR [Digital Video Recorder], so pre and post-event analysis can be carried out to assist the facility's manager to identify any changes that need to be made to the site's fire safety plan. This pre and post-event analysis enables the operator to view what, or who, caused the incident. FireVu also allows seamless integration with a site or sites other safety and security systems, enabling greater use of existing security equipment by including smoke and flame detection.

FireVu is a NetVu Connected product that can provide seamless connectivity to other NetVu Connected products, such as those supplied by other AD Group companies including Dedicated Micros, D-Tec's sister company. IFP

Further details on D-Tec, its technology and FireVu, can be found at www.dtec-fire.com.
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Storage Occupancy Sprinklers:

The Options Are Increasing

Within the last decade, storage occupancies have prevailed as being one of the most challenging and diverse fire protection environments. No other occupancy involves such a wide range of hazards and variety of products stored under one roof.

By Salvatore J. Izzo, P.E.

Technical Services Manager with The Reliable Automatic Sprinkler Company in Elmsford, NY.

and

Thomas L. Multer

Vice President of Product Technology for The Reliable Automatic Sprinkler Company in Liberty, SC.

New materials and commodities, methods and arrangement of storage, building size and increased storage heights have all contributed to this fire protection challenge. Storage classifications have expanded, and storage and retrieval methods associated with these occupancies have changed dramatically, demanding more efficient and cost effective fire protection solutions that could not be provided in the past by the traditional spray sprinkler. Utilizing sprinklers with metric K-factors of 80 (5.6 US) and 115 (8.0 US) often yielded high-pressure requirements where densities of 13.9 mm/min (0.34 gpm/ft^2) and higher were needed. The use of larger pipe, looped cross-mains, and fire pumps with higher-pressure ratings were needed to meet the hydraulic demands of the sprinkler system. No longer does one sprinkler orifice size fit all storage applications.

The sprinkler industry and the testing laboratories recognized that these changes required something more than the traditional methods of protecting these occupancies. Based on full-scale fire testing by manufacturers and consortium groups, the fire dynamics associated with different fuels and their arrangement are being learned and applied to new sprinkler technology. Laboratory capabilities accommodating new design parameters for fire testing, as well as knowledge gained from past fire loss experience, have assisted to this end. The use of standard orifice 15mm (½") and large orifice 20mm (17/32") spray sprinklers will be limited in the future as sprinklers with K-factors of 160 (11.2 US) and greater have demonstrated, through this testing, that they can provide better fire protection while providing cost savings.

Applicable Design Guidelines for Storage Fire Sprinkler Systems

Design criteria defining these storage commodities, arrangements and fire sprinkler requirements are found throughout several National Fire Protection Association (NFPA) standards and HPR insurance regulations, such as FM Global Property Loss

Sprinkler K-factor (Nominal)	"Best-Fit" Design Density Range*
80 (5.6)	Up to 8.2 mm/min (0.20)
115 (8.0)	8.2 mm/min (0.20) to 13.9 mm/min (0.34)
160 (11.2)	13.9 mm/min (0.34) to 15.5 mm/min(0.38)
200 (14.0)	15.5 mm/min (0.38) to 18.0 mm/min (0.44)
242 (16.8)	18.0 mm/min> (0.44)

*Based on the sprinkler flow equation $Q = K\sqrt{P}$, where Q is the flow, K is the K-factor of the sprinkler, and P is the pressure at the sprinkler, and a coverage area per sprinkler of 9.1 m^2 (100 ft^2).

Prevention Data Sheets. Local jurisdictional requirements and preferences may also be in addition to these minimum standards.

Design density curves in the standards and guidelines make use of several variables to determine the proper ceiling sprinkler density requirements. Considerations are given for the type and arrangement of storage, storage height, sprinkler temperature rating, aisle separation distances, use of in-rack sprinklers, stable and unstable piles, and encapsulation. The maximum possible storage height and potential increases in commodity hazards must also be considered.

The standards for the protection of flammable liquids and aerosol storage must be referenced separately.

Types of Storage Sprinklers

All storage sprinklers with the exception of ESFR sprinklers are control mode sprinklers; that is, they limit the size of the fire by decreasing the heat release rate of the fire, wetting the combustibles surrounding the area, and cooling the hot gases at the ceiling. Suppression-mode sprinklers operate in the early stage of a fire, sharply reducing the heat release rate of a fire and delivering a large amount of water at high momentum through the fire plume to the seat of the fire.

Spray Sprinklers – Control Mode

Spray sprinklers having K-factors of 80 (5.6) and 115 (8.0) traditionally have been used for storage protection as stand-alone ceiling systems, or as combination ceiling and in-rack systems. These sprinklers required high operating pressures to meet the higher density requirements for the commodities being protected, and imposed limitations in the flexibility in the type of building storage and storage configurations. Testing as well as loss experience demonstrated that increasing the density for these sprinklers did not guarantee an increase in sprinkler performance.

1. Sprinklers having a K-factor of 80 (5.6) are limited to protecting storage where the design density is 8.2 mm/min (0.20 gpm/ft^2) or less.
2. Sprinklers having a K-factor of 115 (8.0) are limited to protecting storage where the design density is 13.9 mm/min (0.34 gpm/ft^2) or less.
3. For densities greater than 13.9 mm/min (0.34 gpm/ft^2), sprinklers must have a K-factor of at least 160 (11.2).

With the development of the larger orifice spray sprinklers specifically listed for storage applications, testing showed that their use greatly enhanced the performance of these increased densities. Water characteristics from the initial opening sprinklers lends itself to better fire plume penetration and limits the misting effect that comes from high pressures through a small orifice. Fire control that is more effective was demonstrated over the fire by the initial operating sprinklers, resulting in fewer operating sprinklers (a 50% design area reduction for some storage categories) and more water to be delivered to the initial sprinklers at lower pressure requirements. The lower pressure requirements provide opportunities for cost reductions in pipe sizes, fire pumps, storage tanks, installation, material and labor costs.

To efficiently use the larger orifice spray sprinklers, design densities must exceed certain values based on the minimum .5 bar (7psi) pressure requirement stipulated by NFPA 13. To do otherwise can lead to over-design and a more costly system.

The K-242 (16.8) sprinklers have even more special design reductions, increased storage and building heights, and lower protection requirements for plastic palletized storage.

In-Rack Sprinklers, used in combination with ceiling sprinklers, can apply water directly on to the burning commodity within storage racks, minimizing the water needed from the ceiling sprinklers. These are usually ordinary temperature rated, standard or quick response sprinklers having K-factors of 80 (5.6) or 115 (8.0). Although the combination of ceiling sprinklers and in-rack sprinklers is an effective method of protection, in-rack sprinklers add cost and maintenance to the system as well as limit the flexibility of building storage configurations.

Large Drop and Special Application Control Mode Sprinklers

As storage technology changed and new materials developed, storage heights increased and commodities became more hazardous. High challenge fires associated with these new types of storage occupancies produced fires with large quantities of hot gases at high velocities, and thus, higher fire plume momentum. The large drop sprinkler was specifically developed for these high fire challenges. Large drop sprinklers, which have a K-factor of 160 (11.2), were designed to produce droplets of increased mass and corresponding velocity for effective plume penetration, attacking the fire at the source and relying less on prewetting. This was the first sprinkler that enabled the elimination of in-rack sprinklers. Their use has decreased within recent years with the advent of ESFR technology. The industry will continue to change as we add Special Application Control Mode Sprinklers with K factors of 242 (16.8) and larger. As with Large Drop sprinklers, these sprinklers are listed at a minimum operating

pressure with a specific number of operating sprinklers based upon commodity, building height, storage height, and storage configuration. These sprinklers can be installed on dry and double interlock preaction systems and are especially advantageous when used in cold storage areas.

Extended Coverage Storage Sprinklers

The newest additions to the control mode sprinkler line are the K-363 (25.2) density/area sprinklers with coverage up to 18.2 m^2 (196 ft^2) and spacings up to 4.3 m x 4.3 m (14ft. x 14ft.).

There are both upright and pendent versions available. Reliable's pendent sprinkler can also be recessed for installations below finished ceilings. These storage/extra hazard sprinklers differ from other EC sprinklers in their calculation procedure. Light and ordinary hazard EC sprinklers are calculated based upon a flow and pressure derived from fixed incremental spacings of .6 m (2 ft.). The EC storage sprinklers are calculated based upon the actual coverage area per sprinkler, which prevents over design of the total calculated water flow. The savings on the quantity of line piping and the large K factor that reduces the starting pressure will make these sprinklers very attractive to the storage market.

Early Suppression, Fast Response (ESFR) Sprinklers

Early suppression fast response (ESFR) sprinklers are the only sprinklers listed/approved as suppression-mode sprinklers. The concept of ESFR protection is such that if a sufficient quantity of water can be delivered on to the burning commodity at the early stage of fire development, the fire can be suppressed quickly before a severe fire challenge occurs.

The suppression capability of ESFR sprinklers is a function of the size of the fire when the sprinkler operates, rather than a direct function of the burning characteristics of the protected commodity within a designated area. This is critical to the success of an ESFR system. The discharge spray of ESFR sprinklers is of sufficient momentum and density so that it effectively penetrates the fire plume and delivers a sufficient quantity of water directly to the burning fuel commodity. Benefits unique to ESFR sprinklers include superior performance and operational flexibility in accommodating changing commodities and storage arrangements.

Within recent years, several types of ESFR sprinklers have emerged to meet the challenges of the built environment, to add flexibility of installation and enhanced design features. Typical K-factors for ESFR sprinklers are both pendent and upright K-200 (14.0) and K-242 (16.8), and pendent K-320 (22.4) and K-363 (25.2).

Of special interest are the K- 320 (22.4) and K-363 (25.2) ESFR sprinklers. These sprinklers can protect buildings up to 13.7 m (45 ft) in height with up to 12.2 m (40 ft) storage heights, without the use of in-rack sprinklers, and at lower pressures. A building exceeding 12.2 m (40 ft.) in height using K-200 (14.0) or K-242 (16.8) ESFR sprinklers also requires one level of in-rack sprinklers. This makes the K-320 (22.4) and K-363 (25.2) ESFR sprinklers very popular for these building heights, since they did not require the use of in-rack sprinklers. The Reliable K-320 (22.4) ESFR

sprinkler is particularly attractive since it can provide the same level of protection as a K-363 (25.2) ESFR sprinkler, but with less water required. Minimum system design savings over a K-363 (25.2) ESFR is 818+ L/min (216+ gpm) for cULus and 908.5+ L/min (240+ gpm) for FM Approval. These lower flow requirements provide the opportunities to reduce interior and underground pipe sizes, fire pump sizes, and tank sizes.

ESFR sprinklers may be the answer for some applications but simply cannot be used for others. A heightened awareness is necessary of the unique limitations and applications of ESFR sprinkler technology. Because obstructions can significantly effect their performance, careful planning and coordination by the various disciplines is essential for the successful installation and performance of this type of sprinkler system.

Summary

More than ever before, there are many types of storage sprinklers to choose from and the list is increasing. The development of larger orifice storage sprinklers, extended coverage sprinklers, and the expansion of ESFR and Specific Application Control Mode technology enable more effective and feasible fire protection for these challenging occupancies. It is important that the application, limitation, and installation criteria for these types of sprinklers be understood and that the applicable documents pertaining to their use be followed. IFP

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High Pressure Water Mist:

How the Technology Works

As a process, fire involves chemical reaction between combustible fuel species and oxygen from the air. The prerequisites of sustained burning are:

- Combustible fuel, which can be solid (Class A), liquid (Class B) or gas-phase
- Oxygen
- Heat for ignition
- Uninterrupted chemical chain reactions

Fire size is characterised by its heat release rate, measured in Watts (W). The order of magnitude in small smouldering fires (no flames) is 100 kW, a flaming fire that can be approached by a hand-held extinguisher is under 1 MW, and the fire is extensive when it is above 5 MW. As a rule of thumb: 1 m3 of visible flame corresponds to 1 MW fire.

To extinguish a fire, at least one of the four pre-requisites must be removed. Very seldom the fuel itself can be removed, but the three other parameters can be affected by different fire fighting agents:

- Oxygen concentration can be lowered, e.g. by adding inert (non-reactive) gas into the fire.
- Heat can be removed, e.g. by wetting the combustible surfaces.
- Chain reactions can be interrupted by adding a chemical that reacts with unstable sub-products of combustion.

Fires can be fought by fixed fire fighting systems and/or manually. Fixed systems are typically required to at least control the fire, manual intervention is often necessary to complete the extinguishment and prevent re-ignition. The three different fire-fighting terms used are extinguishment, suppression, and control. The meaning of these words is different and one should be careful in using them, so that the system performance would not be unintentionally under- or overestimated and that the client would not be provided with false expectations. The terms can be defined as:

Fire extinguishment	Complete elimination of any flaming or smouldering fire (preventing re-ignition).
Fire suppression	A sharp reduction in the heat release rate and prevention of re-growth of the fire.
Fire control	Limitation of fire growth and prevention of structural damages.

Manual intervention is always required to complete the extinguishment in case of applying suppression and/or control systems.

Fixed fire fighting systems may be *total flooding systems* that protect an entire enclosure by filling it up with the agent, or *local application systems* that protect objects locally.

Water mist as a fire fighting agent

Water is the oldest, the most widely used and the most widely available fire fighting agent in the world. It is non-toxic, environmentally friendly, and in addition: it has superior fire fighting capabilities in a wide range of applications as compared to any other agents.

Water has two major fire fighting mechanisms, both related to the evaporation of water:

- *Cooling*
  When turning into vapour water absorbs more heat that any other fire fighting agent.
- *Inerting*
  In evaporation the water volume expands over 1700 times displacing oxygen.

Evaporation rate of water depends on the free surface area: water in a bucket evaporates much more slowly than the same volume spread as a thin layer on the floor. The free surface area can be increased by splitting the bulk volume into droplets: the smaller the droplets are, the faster is the evaporation and the more efficient is the cooling and inerting.

Water in the form of mist can have an additional fire fighting mechanism that no other agent has:

- *Blocking of radiant heat*
  A dense cloud of small water droplets effectively absorbs and scatters heat radiation.

The droplet size has a considerable effect on the surface area and the number of droplets as illustrated in the following table describing the properties of one litre of water:

Droplet size (mm)	Number of droplets	Surface area (m^2)
10	1.9×10^3	0.6
1	1.9×10^6	6
0.1	1.9×10^9	60
0.01	1.9×10^{12}	600
0.1 x	1000 x	10 x

Decreasing the droplet size by a factor of ten increases the surface area (and evaporation rate) by a factor of ten and the number of droplets by a factor of thousand! Hence, a lot less water is needed for the same cooling and inerting efficiency than in conventional water spraying systems. And additionally, the surroundings are protected against radiant heat.

Small droplets as such do not guarantee efficient fire fighting capabilities: they also need to reach the flames, i.e. they need to *penetrate* the outward flows induced by the fire.

The fire fighting capabilities of a water mist system are hence defined by

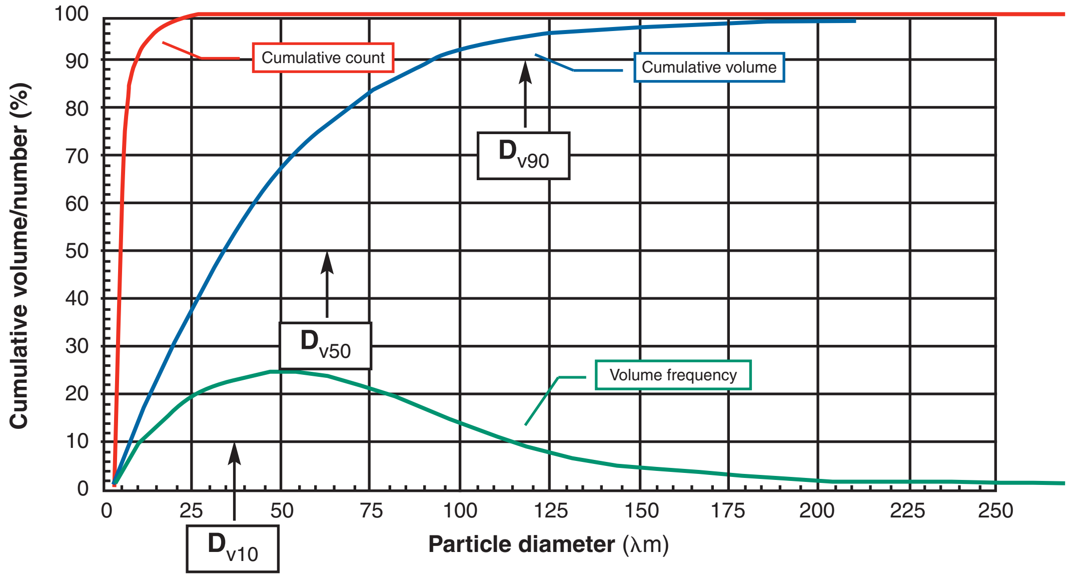
(i) drop size distribution,
(ii) number of droplets and
(iiii) penetration.

The combination of these properties is entirely system-specific.

Total flooding vs. local protection with water mist

Total flooding is possible only in enclosed spaces. In general, fires are always easier to extinguish in enclosed spaces than in open, and – for water mist specifically – in enclosed spaces larger fires are easier to extinguish than small fires. Less extinguishing agent per unit volume is also needed in enclosed spaces than in open for the following reasons:

- In enclosed spaces the extinguishing agent is contained inside the space around the fire. It



does not escape anywhere and, hence, no losses to the surroundings need to be covered.

- In enclosed spaces the fire itself consumes oxygen and helps in the extinguishing process. The larger the fire is, the more it consumes oxygen and the less additional extinguishing agent is needed.
- In enclosed spaces the fire heats up the enclosure. Large fires generate more heat, and the higher the ambient temperature is, the more water vapour is in the air (up to saturation). At around 60°C there is enough water vapour in the air to inert the atmosphere and extinguish the fire.

Local protection is applied in large or open spaces where a full simultaneous coverage of the complete area is not possible. In local protection applications enclosure effects cannot be accounted for. In large or open spaces smaller fires are easier to extinguish than large fires. More extinguishing agent per unit volume is also needed in open spaces than in enclosures for the following reasons:

- In open spaces the extinguishing agent is continuously lost into the surroundings and the losses need to be covered by increasing the discharge rate of the agent.
- In open spaces there is an unlimited supply of oxygen, the fire does not affect the oxygen concentration.
- In open spaces the fire does not affect the ambient temperature in the neighbourhood. At a close distance the temperatures are naturally high but the formed vapour is continuously lost into the surroundings. Vapour inerting is not possible in the open space.
- In open spaces there are strong, flame-induced flows outward from the seat of the fire. The larger the fire is the stronger are the flows and better penetration and higher concentration of water mist is needed to overcome the flows

System properties

All water mist systems are unique, and their capabilities cannot be generalised. There are even several different types of systems with characteristic properties and hence system-specific installation criteria.

High pressure water mist systems are powered by constant pressure electric or diesel pumps (pressures up to 140 bar) or by pressurised gas cylinders (pressures up to 200 bar). All the drop sizes usually fall in the range below 200 µm (see the Note below). The penetration length may be up to 7 – 8 m horizontally, and even longer distances may be reached vertically. The good penetration also contributes in spreading the mist throughout the space, even past obstacles. High pressure water mist behaves almost like a gas, which provides a superior property: it can replace not only conventional water spraying systems but also gaseous extinguishing systems.

High pressure water mist systems have a very high cooling, inerting and radiant heat blocking efficiency. Gas temperatures around the fire drop abruptly within seconds after discharge, and the fire is quickly surrounded by a dense cloud of small droplets. The radiant heat is blocked so effectively that at a few metres distance from the fire people do not feel any heat. The adjacent structures are well protected, even when the fire is still burning.

Depending on the application, the water mist systems are designed to extinguish (typically flammable liquids) or suppress and control (solid fuels) the fire.

High pressure water mist systems are a major development in water-based fire protection. The number of areas of application, test standards and performance criteria, type approvals, and market acceptance in form of customer references keep growing at an increasing rate.

Note: Drop size distribution

Drop sizes of a spray cannot be described with one single number. A spray always consists of a wide range of different drop sizes, and it can be described in many different ways. An example of a high pressure water mist spray is given below.

Three different curves of the same spray are shown: The most widely used curve is the *cumulative volume curve* which is characterised by three numbers: D_{v90} (90 µm), D_{v50} (33 µm) and D_{v10} (8 µm), i.e. the limiting droplet sizes in such a way that 90, 50 or 10% of the *volume* of water is in droplets smaller than that size. The *volume frequency curve* shows e.g. that the largest volume of water is in droplets of 50 µm of diameter. The *cumulative number curve*, on the other hand, shows that 90% of the total *number* of droplets are smaller than 10 µm! Already five different numbers are given to describe the same spray, and there are still several others. Comparing drop sizes needs careful evaluation. IFP

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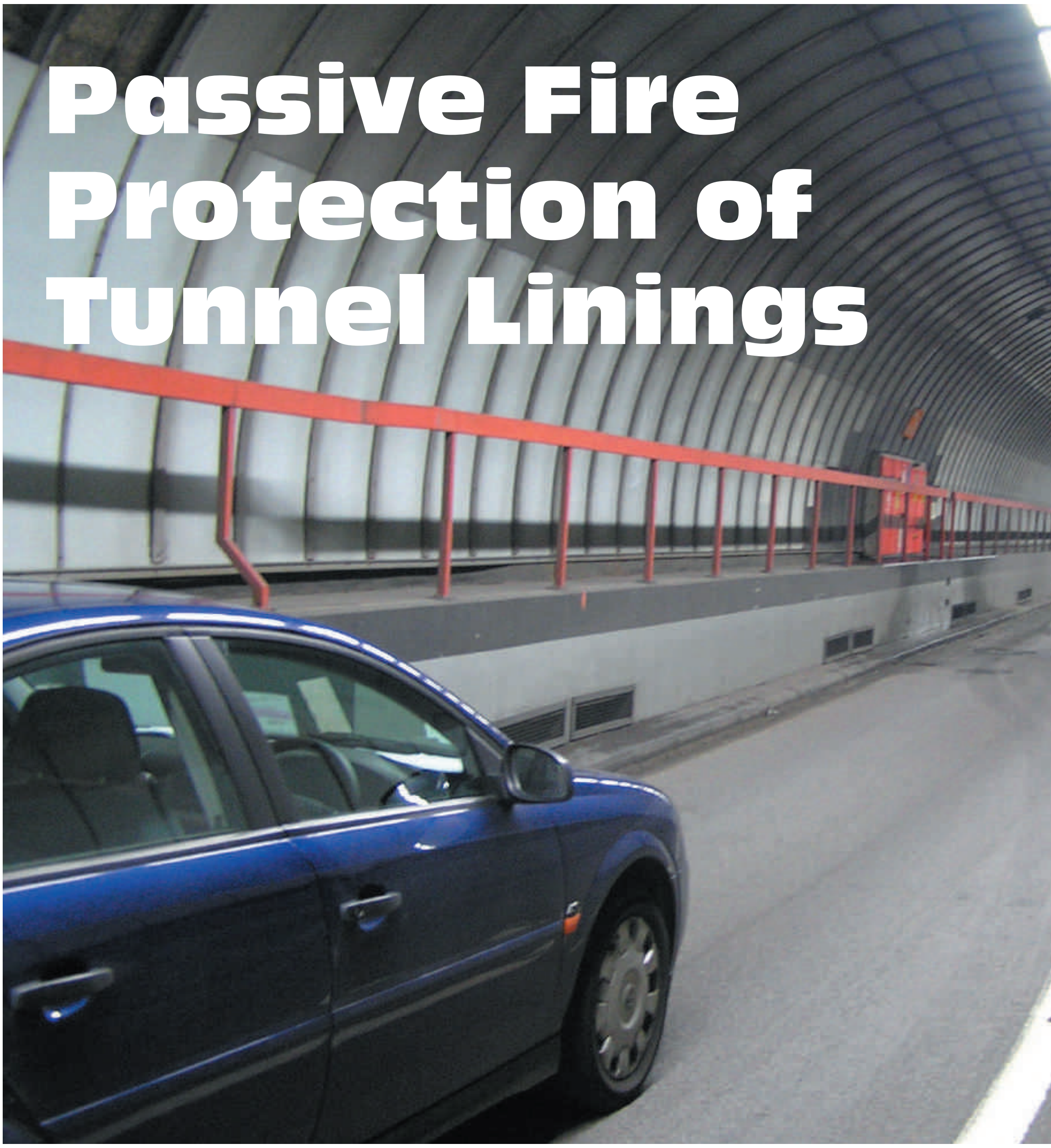


In this article it is explained what the effects are of a fire incident on concrete and steel tunnel linings and the general structure of tunnels within the wider context of fire safety in tunnels.

By Ian Stewart

of Ameron Performance Coatings & Finishes

Discussed are the methods of how existing and new tunnel linings can be upgraded to resist the ''worst case scenario" of a fully developed petrol tanker fire. The recognised standard fire testing to the RWS curve developed in Holland and what it means is reviewed.

Furthermore the use of tunnel lining systems using high performance paint coatings and cladding systems to maintain reflectance levels and resist long-term maintenance cleaning operations is explained.

Effects of Fire on Concrete

In the Channel Tunnel fire (France/England, November 1996) most of the tunnel was lined with reinforced concrete segments, 40cm in depth. The most severe damage was over about 50m and in places the concrete was reduced to around 17cm, with only 2cm remaining in a few locations.

Concrete mixes do vary widely and depend upon the specified grade of physical and chemical properties required in the lining type. Those used in bored tube tunnels are usually high strength, high density, low porosity mixes, while those used in immersed tube tunnels are usually of lower density and high porosity.

Concrete suffers from explosive spalling when subjected to severe fire. This is caused by moisture in the concrete boiling producing high pressure steam, causing the concrete to explode, crack and shatter.

The following scenarios could occur in the event of a fire inside a tunnel and excessive spalling taking place:

- Leakage or collapse before evacuation
- Significant damage. Major repair and retrofit costs leading to economic loss
- Risk the lives of personnel assisting evacuation and fire fighters
- Failure of ventilation anchoring systems and loss of cables trays and associated services.

Spalling has been observed in certain types of concrete at temperatures slightly above 200°C. Once the spalling process starts it is not likely to stop until structural failure.

High temperature will also have an effect on the steel rebar reinforcement. At high temperatures the loss of load bearing capacity of structural steel is well understood. It is recommended that steel reinforcement should be protected so as not to exceed 250°C to 300°C in a tunnel fire.

The protection of the steel reinforcement is most important in immersed and cut and cover tunnels. The risk here is that the horizontal roof may sag if the roof reinforcement is not fire protected. In underwater tunnels this may lead to possible collapse and leakage.

RWS Fire Protection Standard

In the Netherlands the Rijkswaterstaat (Ministry for Public Works and Water Management) takes the view after much research at the TNO laboratories and on existing structures that tunnels must be protected from the ‘‘worst case” fire scenario.

This is the case of a petrol tanker fire with spillage and ignition and no drainage. In 5 minutes the temperature will reach 1100°C. The tunnel wall and ceiling will soon reach 1400°C.

Fire tests are usually required on an individual project basis as each tunnel has its own design and fire performance requirements.

Fire test periods of R120 and R240 have been achieved in accordance with the RWS time/temperature curve for fire resistant boards and vermiculite cement sprays. The fire test is carried out over steel at varying thickness and on pre-cast concrete slabs of dimension 2.5m × 3.5m in a horizontal position.

Fire testing is done to the special heating curve known as the RWS Curve (see next page).

From the comparative graphs of the different fire test curves it can be seen that the RWS Curve is more severe than the hydrocarbon curve used in the petrochemical industry.

Although there is no Internationally recognized standard for tunnel linings. The requirements in the Netherlands are:

1. The steel reinforcement within the concrete shall not exceed 250°C to prevent sagging and collapse.
2. The temperature at the surface of the concrete shall not exceed 380°C to prevent spalling

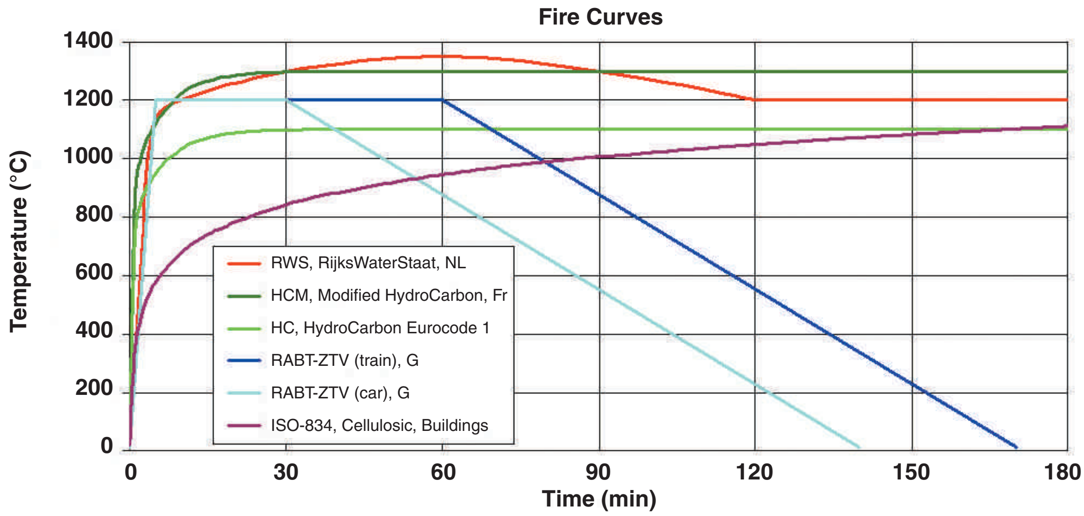
Tunnel lining fire protection systems are fire tested according to one or more of the above time/temperature curves to a recognized standard.

Fire test periods of R120 and R240 have been achieved in accordance with the RWS time/temperature curve for fire resistant boards and vermiculite cement sprays. The fire test is carried out over steel at varying thickness and on pre-cast concrete slabs of dimension 2.5m x 3.5m in a horizontal position.

Methods of Tunnel Fire Protection

The two main methods currently used to insulate tunnel linings both steel and concrete from a severe fire are:

1. Fire resistant boarding mounted on a stainless steel or galvanized steel grid



2 Vermiculite cement (External grade) or ceramic based spray, which are spray applied onto a prefixed retention mesh.

The thickness of each method will be determined by the required end point temperature required on the tunnel lining substrate to resist spalling. This thickness can only be known by carrying out extensive testing to the RWS fire test time/temperature curve and subsequent independent assessment by a recognized fire test assessment laboratory.

Performance requirements of the Tunnel Lining System

The tunnel surface lining must maintain certain levels of reflectivity in order to ensure adequate light transmission from the tunnel lighting.

In accordance with Highways Agency – Design Guidance document Ref: BD 78/99 Part 9 specifies that the wall surface up to a height of 4m shall have a reflectance level of 0.6 and the remaining roof surface shall have a reflectance level of 0.3.

Over cladding the passive fire protection lining with a coated metal panel system has been used. The coating of the panels can be carried out with vitreous enamel or a high performance coating system.

In addition the tunnel lining surface must be able to resist high pressure detergent water jetting on a frequency level of from once a week to every 3 months depending on the tunnel dimensions and level of traffic use.

Over cladding the passive fire protection lining with a coated metal panel system has been used. The coating of the panels can be carried out with vitreous enamel or a high performance coating system.

A vitreous enamel coated panel system was recently used on a tunnel in Hong Kong. An epoxy polysiloxane coating was used on a panel system in the Dartford Tunnel in the UK. Both these methods offer high abrasion resistance, excellent gloss and colour retention and resistance to regular water jetting to clean the surface.

The vermiculite cement and ceramic fibre sprays have to be trowel finished to provide a suitable

The coatings used in tunnel lining systems should have Class O surface spread of flame or equivalent and should not generate toxic fumes when exposed to fire. This tends to eliminate a number of generic types of high performance coatings such as urethane elastomers and polyurethane's.

surface on which to apply a protective coating. If applied onto a stable concrete substrate and allowed to dry for 20 days minimum then overcoating with a high performance topcoat system such as an epoxy/epoxy polysiloxane, can give good results.

The coatings used in tunnel lining systems should have Class O surface spread of flame or equivalent and should not generate toxic fumes when exposed to fire. This tends to eliminate a number of generic types of high performance coatings such as urethane elastomers and polyurethane's.

The tunnel surface is not always dry so waterproof membranes and or stainless steel cladding is used to control water ingress. This stainless steel cladding then requires the application of passive fire protection to protect the tunnel structure. When using vermiculite cement or ceramic sprays in this case the stability of the stainless steel cladding is critical to avoid cracking. The introduction of post formed expansion joints can assist using high performance sealants which can be over painted. IFP

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Testing and Assessment of Fire Stopping and Penetration Sealing Systems:

The 'British' Regime

To date there have been no standardised methods set up within the UK for evaluating the contribution of firestopping and/or penetration sealing systems, either via test or assessment. They have, therefore, been tested by analogy with methods for other separating elements such as the walls and floors within which they are intended to be used. As a result, existing test and assessment data is difficult to compare, there being inevitable differences in methodology.

By Graham Ellicott

Chief Executive, Association for Specialist Fire Protection (ASFP)

Given the wide range of products and product applications, it has not been possible to prescribe a fixed programme of tests. Any programme should be designed to cover, by test and subsequent appraisal the range of sizes, applications and periods of fire resistance required, based on the knowledge and expertise of the assessor.

Currently, products are most likely to have test evidence created by ad-hoc testing to the BS 476: Part 20 regime. The testing is deemed ad-hoc because there is no British Standard in existence specifically dealing with penetration and linear joint seals.

This short article looks at the 'British' regime for the fire testing and assessment of fire stopping and penetration sealing systems. It does not encompass the 'European' regime, which uses fire tests such as (pr)EN 1366: Part 3 (fire resistance tests for service installations: penetration seals) or (pr)EN1366: Part 4 (fire resistance tests for service installations: linear joint seals).

Much of the guidance that supports fire safety legislation is given in terms of performance in relation to British Standards for systems, methods of test, and design. Typically, a system or structure should:

(a) Be in accordance with a specification or design which has been proven by fire test to be

capable of meeting that performance; or

(b) Have been assessed from test evidence as meeting that performance.

Given that a test undertaken on a specific element of firestopping and/or penetration sealing system is a representative evaluation of the likely end use performance and providing the construction tested is replicated in the end use condition, there is little interpretation needed and it can be accepted that the installed element will provide the required fire resistance.

Where the element to be installed is altered, in even the slightest manner, however, the likely effect on the fire resistance performance must be evaluated. This is normally conducted via an assessment report provided by a UKAS accredited test laboratory. The assessment report should address the tested element and the required amendments to the construction and provide justification that the proposed changes are acceptable. The conclusions and limitations within any assessment report should be considered with care, as these can often restrict the use of the tested/assessed element, rendering the construction inappropriate to the particular end use under consideration.

The Association for Specialist Fire Protection (ASFP) recommends that assessments are conducted in accordance with the Passive Fire Protection Federation's publication, 'Guide For Assessments In Lieu Of Fire Resistance Tests'. Those that are not may still be acceptable for regulatory purposes, although their validity should be confirmed prior to acceptance by the appropriate approving authority. Assessments, that follow the guidance within the PFPF Guide, will provide the end user with confidence that the evaluation has been carried out with the necessary care and expertise and is appropriate to the intended use.

Some areas where assessments may be offered are:

- Where a modification is required to a tested construction (this is by far the most common use of assessments)
- Interpolation or extrapolation of results of a series of fire resistance tests, or utilisation of a series of fire test results to evaluate a range of variables in a construction design or a product
- Where, for various reasons (e.g. size or configuration) it is not possible to subject a construction or a product to a fire test.

Assessments will vary from relatively simple judgements on small changes to a product or construction, through to detailed and often complex engineering assessments of large or sophisticated elements.

As discussed above, to date there have been no standardised methods within the UK for evaluating the contribution of firestopping and/or penetration sealing systems via assessment, resulting in a variation in scope depending upon who

provides the assessment. Basic guidelines exist in various forms, but increasingly these are being superseded by adoption of draft European guidance which is currently in an advanced state of development. The Fire Test Study Group (FTSG) have agreed that the draft extended application documents currently under development in respect of the European Standards will be used as the principles for assessment of firestopping and/or penetration sealing systems and this will provide a degree of consistency which has not existed previously.

The assessment report for a firestopping and/or penetration sealing system, prepared using the guidance of the FTSG document, should contain the following information:

1 The name and address of the issuing body
2 The name and address of the sponsor
3 The date of issue of the extended application report
4 The unique reference number for the report
5 Summary of the report(s) that the extended application is based upon
6 The proposed extended field of application of the test results and the justification for that extension
7 Reference to this document
8 Classification of the modified construction in accordance with prEN 13501-2
9 The following statement.

'This extended application report is issued on the basis of test data, information available and the guidance given in the Extended Application

Principles For Tests Conducted in Accordance with BS 476: Part 22; 1987 (or prEN 1366-3). If contradictory evidence becomes available, the position of the extended application report shall be reviewed and the report sponsor notified. The extended application report is valid initially for a period of five years from the date of issue at which time it is recommended that it be returned for re-appraisal.'

The extent to which the application of each firestopping and/or penetration sealing system may be extended is a lengthy subject and for the reader that wishes to explore this further it is suggested that they visit the ASFP website at ***www.asfp.org.uk*** and download a copy of the first part of the publication 'Fire Stopping and Penetration Seals for the Construction Industry', where this subject is discussed by system in section 2.3. IFP

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Arc Plasma Destruction Equipment used to destroy Halons

Halon Management Across International Borders

The Montreal Protocol Treaty lists halons as Class I, Ozone Depleting Substances (ODS). Since the production phase out of halon became effective in industrialized countries in 1994, the transition from halons to alternative replacement agents has been a challenge for everyone involved in the international fire protection community.

By Richard M. Marcus

President Remtec International

During this time it was hoped that a true drop-in replacement agent for Halon 1301 could be found, but this has not happened. However, there are now a number of replacement agents available that can be used for most commercial applications, especially where space and weight are not critical, or ambient temperatures are not extremely low. The U.S. EPA has, under the Significant New Alternatives Policy (SNAP) program, listed several acceptable alternative agents and technologies for total-flooding and streaming applications. Although the SNAP program offers a wide array of choices, these agents have unique characteristics and must be carefully selected and engineered for each fire protection application. Despite this more fragmented approach, consumers and industry now have available effective fire protection alternatives that are non-toxic and environmentally friendly.

Although halons are severely limited in their use, they still are relied upon to protect specific applications that are considered "critical" in accordance with the decisions of the Montreal Protocol Treaty. For example, commercial airframe manu-

Laboratory Test of Purity using Gas Chromatography

facturers are currently designing and building new aircraft such as the A380 and 787 that use Halon 1301 for engine nacelle and cargo bay fire protection applications where high altitudes and low temperatures prohibit the use of new SNAP alternatives. Militaries around the world face similar challenges especially on critical weapon platforms where personnel are at risk. Also, a limited number of petrochemical companies with oil exploration operations in extremely cold conditions require Halon 1301.

The demand in the United States for Halon 1301 used in critical applications is higher than in other industrialized countries. Correspondingly, since 1994 the domestic halon inventory has consistently fallen short of this demand.

These critical needs will continue to exist for several decades. Although it is projected that there is enough installed halon to satisfy future requirements, the fire protection community must strive to find ways to safely recover and reclaim halon from non-critical installations around the world and make it available for critical uses.

The demand in the United States for Halon 1301 used in critical applications is higher than in other industrialized countries. Correspondingly, since 1994 the domestic halon inventory has consistently fallen short of this demand. Therefore, it is projected that the United States must continue to import Halon 1301 for the foreseeable future. Importing a hazardous ODS across international borders is necessary, but uniquely challenging. Holders of halon should be aware of all regulatory and logistical issues before entering into agreements to sell or transport their halon.

Import and Export Permits

The Montreal Protocol allows for and encourages the transfer of halon across international borders. This is an important halon management strategy that satisfies the critical needs in one country from excess inventory in another, thus obviating the need for further production. However, the problem presented is how to safely and effectively move these Ozone Depleting Substances (ODS) across international borders? In response, the Parties to the Montreal Protocol have implemented a formal petitioning process that controls all ODS imports and exports. The Import Petition Process requires importers of previously used halon to provide details regarding its installed use. Import approval is not granted until all regulatory authorities are satisfied that the recovered halon is not newly manufactured "virgin" agent. In the European Union (EU) halon owners should be aware that exporting halon is specifically limited to a specific critical use list found in Annex VII of EC Regulation 2037/2000.

The U.S. EPA diligently collaborates with other federal and international agencies to prevent illegal imports. In the United States, an ODS import license is called a Non-objection Notice. Obtaining this approval is an involved process that can take a minimum of 40 days from the time of application to final approval. However, if there are any inconsistencies in the information that is provided, the approval can take even longer, or it may be rejected. It is therefore important to allow enough time meet these regulatory requirements before attempting to ship halons or any ODS material across international borders.

A separate area of concern are taxes levied on imported ODS material. For example, in the United States in 1989, the Internal Revenue Service implemented a substantial excise tax on imported ODS including Halon 1211. However, in order to meet

critical needs in the United States used Halon 1301 is exempted from this tax.

Transportation Issues

Halon is generally considered a hazardous material because it is stored and transported under pressure. Each country has specific regulations approving pressure vessels. For example, in the United States tanks transporting halons and other gases must be manufactured in accordance with Department of Transportation (DOT) regulations. Most foreign made pressurized tanks are not recognized by DOT and therefore cannot be used in the United States even on a temporary basis without obtaining prior approval from DOT. This special exemption is very difficult to obtain. Over the last several years a rumour circulated that non-DOT tanks could be used if transporting halon within a 5-mile radius from the point of importation. This is false and fines for violating these regulations are substantial.

International Halon shipments are usually shipped onboard ocean carriers. The International Maritime Organization (IMO) also has its own unique set of regulations that pertains to the transportation and storage of pressurized bottles aboard ship.

The provision with the most significant impact is the prohibition of shipments to and from countries that are not party to the Basel Convention. The exception to this requirement is the existence of multilateral, regional and bilateral agreements.

The movement of recovered ODS material may also fall under Basel Convention regulations related to the trans-border movement of dangerous goods. The provision with the most significant impact is the prohibition of shipments to and from countries that are not party to the Basel Convention. The exception to this requirement is the existence of multilateral, regional and bilateral agreements.

Testing and Validation

Before transferring ownership, it is important to confirm that the gas purchased is in fact halon, and not cross-contaminated with another halocarbon, or a completely different gaseous substance. Using an indicator machine that is accurate within 2% can initially test purity. A Gas Chromatograph (GC) however, provides much more accurate results since Halon 1301 is required to be 99.6% pure. Samples are taken using lecture bottles especially designed for this purpose and should be sent to a laboratory that has experience testing halocarbons. Most laboratories that are approved by the Air-Conditioning & Refrigerant Institute (ARI) routinely test halons to ASTM, ISO or U.S. Military Specifications. At the very least they can provide a simple purity analysis.

As we move farther away from the time when halons were newly produced, and as these agents are pumped, transferred, reclaimed and recycled many times over, the chances of pure halon becoming mixed with other agents becomes greater. In a few cases, outright fraud is involved. Although used halon is commonly contaminated with water, particulates and in some cases oil, cross-contamination with another halocarbon should be avoided if possible. Once cross-contaminated, the only way to return these halocarbons to specification is to use a fractional distillation column, which can add substantially to the reclamation cost. It is best to know what you are buying before transferring ownership. Let the buyer beware!

Importing Halocarbons for Destruction

In April, 2006 at the 48th Meeting of the Montreal Protocol's Executive Committee, a report was issued that outlined the need for the Parties to accept unwanted ODS material for destruction from countries that cannot afford to do so, or that do not possess approved destruction technology. Since effective ODS destruction technology is not universally available, the United States has made a commitment to accept these substances for destruction. At the time of this writing the U.S. EPA is working in conjunction with the Executive Committee to find ways to facilitate this process.

Although the U.S. EPA has not finalized all procedures, there are certain issues that should be addressed when transporting ODS material into the United States for destruction. Because Halon 1301 is still needed for critical applications, it should be reclaimed to an accepted international specification such as ISO7201 or ASTM D5632-95. However, in some cases reclaiming an ODS such as halon is not possible, either because it has become so badly deteriorated, or as in the case of Halon 1211, it may no longer have a critical use. In either case it is illegal to intentionally vent any ODS, therefore destruction may be the only disposal option. In the United States, safe and effective recovery is required by regulations governing handling and proper disposal. These rules are designed to minimize emissions of halon, and maximize recapture and recycling. Failure to follow these rules can result in fines of up to $27,500 per day per violation. Most countries that are Parties to the Montreal Protocol have adopted similar regulations.

It is important during the destruction process to obtain complete documentation. The owner of the Halon should insist that the company performing the destruction service provides a Certificate of Destruction (COD). The COD should confirm that the Technology and Economic Assessment Panel (TEAP) guidelines have been followed, and that Destruction Efficiency (DRE) levels of 99.9999% are routinely achieved. If the destruction facility is accurately controlled and instrumented, it can also provide information that correlates GC results with data monitored at the point of destruction. This information is used to confirm that the halocarbons imported into the United States for destruction were in fact destroyed. The report should also contain the date/ time, volume and the molecular signature of the destroyed ODS. It is important to have this information readily available for a third party regulatory review. IFP

This article only briefly discusses a few key issues concerning the transfer of halons and other ozone depleting substances across international borders. Please consult the following web sites for more detailed information regarding good practices and applicable regulations:

www.epa.gov/ozone
www.nfpa.org
www.harc.org
www.unep.ch/ozone
www.teap.org/html/halons.html
www.remtec.net

Unique Applicatio
Voice Fire Alarm S

Today's fire alarm systems allow for a vast variety of design options in order to meet the needs of a facility's configuration and operation. With the constantly improving technology of fire alarm systems, engineers and designers may utilize multiple types of visual and voice notification devices often without requiring the use of the same manufacturer. This allows for fire alarm systems to be designed for unique building applications while: Continuing to meet local building and code requirements, adding flexibility in the type of voice or signaling devices, and reducing the overall cost for a new or replaced fire alarm system.

By Michael Reardon

Associate for Rolf Jensen & Associates, Inc.

Uses for Multi Channel Voice Systems

Most fire alarm manufacturers have expanded their capabilities and options with voice alarm systems including the addition of audio channels. A typical voice alarm system consists of at least two analog audio channels which are utilized for a pre-recorded voice evacuation message and for manual paging controls. Many manufacturers also provide the option for digital audio channels which allow for additional channels to be added to the system while utilizing a single wire pair serving the fire alarm speakers. Additional audio channels allow facilities to notify their occupants regarding events other than fire events.

With the unique environmental conditions throughout the world, facilities may be subject to rapid and often violent environmental changes which may require that occupants be notified immediately. Facilities in the mid-West may be often subjected to tornados, while facilities along the West coast may be subjected to earthquakes.

Many manufacturers also provide the option for digital audio channels which allow for additional channels to be added to the system while utilizing a single wire pair serving the fire alarm speakers. Additional audio channels allow facilities to notify their occupants regarding events other than fire events.

Other rapid environmental changes such as flooding, hurricanes, typhoon, tsunamis, blizzards, and wind may also affect a facility depending on its location. Multi-channel voice fire alarm systems allow for pre-recorded messages to be broadcasted over the fire alarm speakers in order to alert occupants and provide crucial evacuation or protection procedures.

Facilities in the mid-West may be often subjected to tornados, while facilities along the West coast may be subjected to earthquakes. Other rapid environmental changes such as flooding, hurricanes, typhoon, tsunamis, blizzards, and wind may also affect a facility depending on its location.

With the incidents that occurred on September 11th, 2001, new security and anti-terrorist concerns lead to strict changes in protecting citizens and facilities. Some of these changes consisted of the re-evaluation of evacuation procedures and additional life safety code protection. Additional pre-recorded or even live messages allow occupants to be notified of an event which may hinder normal evacuation or create additional hazards to occupants if they follow normal evacuation procedures. These messages may give additional information to occupants during evacuation and/or may re-direct occupants to certain exit locations. Some facilities may require that main entrances be secured during a possible terrorist threat which will greatly hinder normal evacuations. Most facilities in the United States are designed in accordance with the *International Building Code* or *NFPA 101, Life Safety Code* which allow a maximum of 50% of all occupants and exit enclosure capacities to exit through areas on the level of discharge, which are often located

ns for Visual and ystems

at or near the main entrance area of a facility. Pre-recorded or live messages allow for occupants to be notified to egress at certain exits, remain in place, or evacuate to a designated area of refuge.

Mass notification is being utilized throughout many campus wide facilities in order to provide emergency and security notification during any type of event. Fire alarm and security systems are integrated to a common voice and alarm system within the perimeter of the campus in order to provide notification and/or direction to occupants.

Fire alarm and security systems are integrated to a common voice and alarm system within the perimeter of the campus in order to provide notification and/or direction to occupants. Voice systems may consist of fire alarm speakers, public address speakers and loudspeakers.

Voice systems may consist of fire alarm speakers, public address speakers and loudspeakers. These voice systems must provide simultaneous notification to occupants during the time of an event, whether it involves a fire or security event. Multi-channel voice alarm systems allow for a variety of notification options including live messaging.

Marking Egress Paths

Emergency evacuations are often difficult in facilities with large floor areas since they require traveling long distances to reach an exit. Traveling long distances may require navigating around multiple corners, and through corridors and open office spaces. Horizontal exits are utilized in large floor plate facilities in order to meet maximum allowable travel distance specified in the IBC and NFPA 101, however occupants may become confused when they reach a horizontal exit since they are simply entering into a new area within the facility rather than reaching an exterior exit door. Emergency events may also create a sense of urgency or panic with occupants in which they may re-enter horizontal exits or travel past exits in following their most familiar route to egress the facility. Occupants who are not familiar with the facility may wander throughout the facility in order to find the most feasible exit, but may inadvertently travel farther distances than necessary.

Scrolling displays offer occupants a sense of direction in potentially confusing floor configurations. Facilities with multiple corridors may utilize scrolling displays in strategic locations in order to "point the way" to exit doors. Scrolling displays may be programmed to provide signals such as arrows and text messages such as "EXIT THIS WAY." They also provide occupants with warning signs such as "DO NOT ENTER" in order to prevent occupants from entering or re-entering a fire or emergency event area.

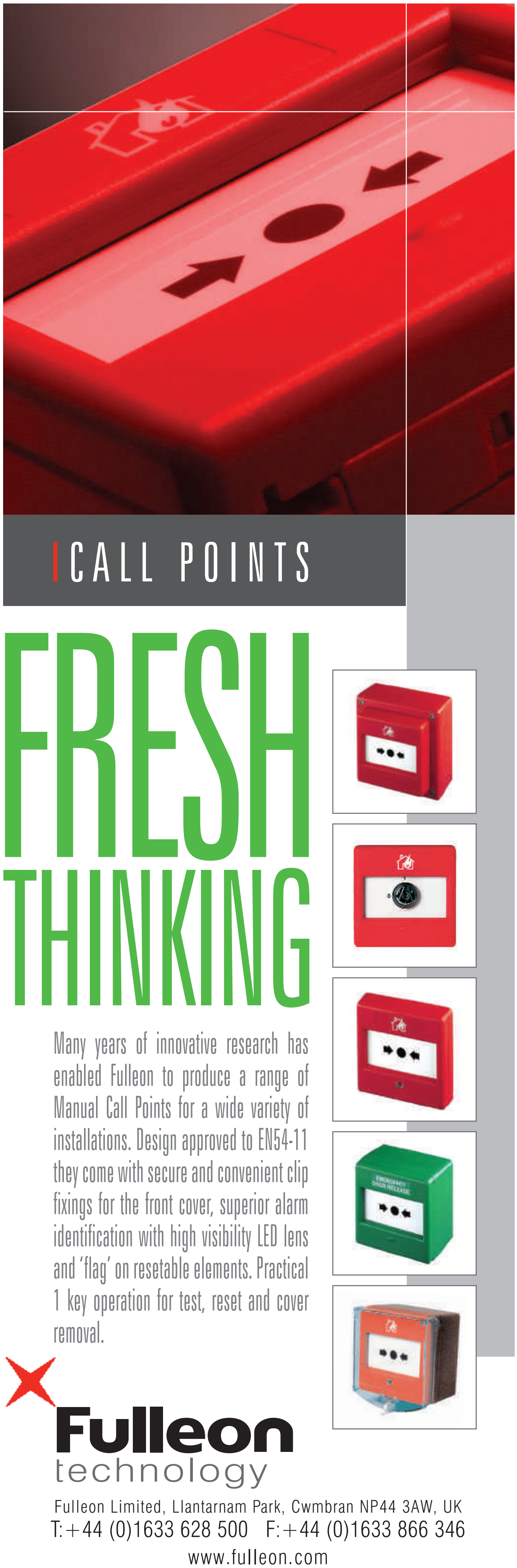
As mentioned earlier, horizontal exits may confuse occupants during an emergency event evacuation. One commonly confusing horizontal exit design is the use of fire-rated accordion doors, or Won Doors. Since these doors are often hidden during normal facility operations, occupants are not aware of their presence until an emergency event. When these doors activate, occupants may turn around when they see the doors closing, rather than reopening the doors by pushing the "OPEN" button provided on the door or neighboring wall. All horizontal exits should be evaluated for potential confusion during evacuations and should be corrected by the use of signage and/or voice notification. For example, in order to alleviate the potential confusion with Won Doors,

One commonly confusing horizontal exit design is the use of fire-rated accordion doors, or Won Doors. Since these doors are often hidden during normal facility operations, occupants are not aware of their presence until an emergency event.

additional signage could be added and a voice recording may provide directions to occupants on how to re-open the doors and continue with their evacuation in the same direction.

Secured Facilities

While a typical facility requires occupants to evacuate the facility or relocate to another area during a fire event, many secured facilities require occupants to remain in place. While a building may be specifically designed to provide defend-in-place protection with the utilization of fire and smoke rated building elements, fire alarm systems are often overlooked when it comes to facility procedures. If certain areas require occupants to remain in place at all times, providing evacuation



notification within these areas may not be feasible. However, occupants within defend-in-place areas still need to be notified that an emergency event is occurring within the facility. This may be performed by providing different pre-recorded messages which provide information as to the fire

Local building and fire codes may not require voice alarm systems within certain types of facilities; however the horn or bell fire alarm systems permitted may not meet the needs for adequate occupant notification.

location. If audibility is a concern, utilizing different visual devices such as rotating beacons or colored visual devices may allow for adequate notification. Some areas may not allow any other type of audible sound due to the interruption of facility operations. By providing additional visual devices, these occupants can still be notified of an emergency event in an efficient manner. Emergency event procedures within secured facilities need to be carefully analyzed and coordinated with the fire alarm system design to be effective. Local building and fire codes may not require voice alarm systems within certain types of facilities; however the horn or bell fire alarm systems permitted may not meet the needs for adequate occupant notification.

Existing Building Configurations

Existing facilities may not meet today's building and fire code requirements which, in turn, could create problems with emergency notification or evacuation. While a facility's structure or building

While a facility's structure or building systems may meet the code requirements for existing facilities, problems may have arisen which could affect a multitude of life safety elements.

systems may meet the code requirements for existing facilities, problems may have arisen which could affect a multitude of life safety elements. For example, a facility's original fire alarm system may be in correct operating order, but occupants may have noticed problems with audibility in certain areas from past fire alarm activations. Another example would be that occupants have to egress longer distances than allowed by current code requirements. This may cause concern to occupants or building owners, however renova-

tions to alleviate the issues may not be feasible due to excessive renovation costs. Fire alarm voice and signaling systems may be utilized to correct issues with existing facilities without excessive building or existing system renovations.

The addition of notification appliances will often correct audibility issues; however certain areas may need special attention. Areas with excessive or constantly changing ambient noises may delay occupants from hearing an alarm, even if the fire alarm system meets the audibility requirements. Rotating beacons, additional strobes, and even loudspeakers may assist with faster notification times.

Voice and signaling systems may assist with existing facilities with excessive or confusing floor areas as previously discussed. The building's configuration should be carefully examined in order to determine the most appropriate locations for additional signaling devices. In addition, existing building fire rating may not meet today's code

The building's configuration should be carefully examined in order to determine the most appropriate locations for additional signaling devices. In addition, existing building fire rating may not meet today's code requirements.

requirements. Fire compartmentalization may not be as affective with existing facilities compared to facilities being constructed today. Egress routes should be analyzed in order to prevent occupants from entering into areas which could create additional hazards during an emergency event. Emphasis should be made on creating the most efficient methods for occupant evacuation with existing facilities which are limited in fire protection.

Conclusion

With the improvements and changing technology within facility building designs and operations, a typical prescriptive fire alarm designs are not always feasible. Fire alarm systems being designed for unique facilities often require that the systems exceed the minimum code requirements or be designed by utilizing performance-based design methods. Many of the previously discussed design methods reflect performance-based design methods. These designs should be carefully examined in order to evaluate that they not only meet the facility's needs but also meet the intent of the code by providing the minimum life safety requirements. IFP

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EN54 approved – glass free call point resets after use

The 'ReSet', is approved to EN54-part 11 and is a unique manual call point that mimics the look and feel of breaking glass whilst offering the user the benefits and environmental advantages of a resettable operating element. Once activated a warning flag drops in to view easily identifying the call point that has been operated. Any member of staff using a simple key can then instantly reset the unit. This ensures that the call point and fire alarm system is quickly operational again, limiting down time of the system to a minimum. The 'ReSet' cannot be inappropriately reset using foreign objects lodged in the unit – as has occasionally happened with break glass units where the user wanted a quick fix solution after the activation.

The 'ReSet' also offers significant advantages for the installer. The unit is virtually maintenance free with the operating element being reset after activation with a simple key – no glass elements to break, lose or incorrectly fit during installation. Unlike traditional break glass units, which use a key for testing, the 'ReSet' provides a complete functional test with every activation. The units are supplied with two independent resistor values accessible via different terminal combinations and have low-profile, heavy-duty terminations to further ease installation.

Since the 1960's the 'break glass' manual call point has been the standard way of activating a fire alarm system. The glass element was introduced as a deterrence to malicious or accidental activation. However, there are safety issues. They cannot be used in areas that are sensitive to broken glass such as food processing plants, swimming pools and leisure centres. Once operated the glass element requires replacement, often by calling out a professional fire alarm company. This can give the user and / or fire alarm company a problem as they must identify the manufacturer of the break glass to ensure the replacement is the correct one. This can involve a costly, time consuming delay before the fire alarm system is fully operational again with obvious safety implications.

The 'ReSet' manufactured in the UK through a strategic alliance with Vimpex Ltd solves these problems and provides an ideal solution for any fire alarm system and in particular for areas that suffer from a high number of false activations such as schools, shopping centres and other public places.

For many years STI products have been helping prevent false fire alarms as well as vandalism, theft, accidental damage and the misuse of devices and equipment that protect people and property. The 'ReSet' complements these products and ensures continued safe and reliable fire alarm operation.

For product information contact:
Mrs Michala Ford
Safety Technology International (Europe) Ltd; STI (Europe)
Sales Freephone (UK): 0800 085 1678
Tel: 01527 520999 Fax: 01527 501999
Email: sales@sti-europe.com
Website: www.sti-europe.com

Fulleon's CX range answers the call

The CX range of call points from Fulleon has been around since 2001 when it was developed to meet the requirements of the European standard EN54-11 – the first call point to meet the standard. The original version introduced several new features to call point design: the clip front cover, enabling quick removal using the test/reset key; the option of glass break or plastic resettable operating elements; the capability to operate with conventional or addressable electronics; a key switch operation for secure areas such as prisons; and weatherproof options (to IP67) for all versions.

The features have been retained but a number of painstaking revisions have been made to the design to accommodate customer comments and improve functionality and performance. Amendments have also been made, alongside many other Fulleon products, to bring the CX call points in line with the Waste Electrical and Electronic Equipment (WEEE) and Restriction on the use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directives.

At one point the CX range had grown to over 750 configurations so Fulleon decided to rationalise, analysing the different versions and recognising that a number of common features could be supplied in one standard package, simplifying both ordering and stock holding for customers.

The new package comprises:

- A CXL call point with LED alarm indicator
- Choice of connection for 470R or 680R resistors
- Fitted glass element
- Supplied resettable element
- Test / reset / cover removal key
- Fixing screws
- Back box
- Installation leaflet with drilling template for back box

The package addresses the common needs of most installers: electrically compatible with most conventional fire systems, options to use glass or plastic resettable operating elements and a back box.

Fulleon's full range of CX call points is still available, as are all the custom design and labelling services. However with a single package covering a large number of common applications, logistics are improved and stocking simplified.

Further details from:
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Fulleon Ltd
Tel: +44(0)1633 628500
Fax: +44(0)1633 876007
Email: sales@fulleon.co.uk
Website: www.fulleon.com

Cranford Controls

Cranford Controls' comprehensive family of Call Points for indoor use has recently been extended with the addition of additional models optimised for fire, security and process control applications; all versions share a common appearance and offer a number of features designed to speed the installation process and improve usability in service.

The original entry-level units are very competitively priced and easy to install. Available with either a break glass or resettable operating element, which are freely interchangeable into the standard body, enables the unit to be optimised to the application. All devices are fitted with a 470 Ohm resistor as standard, and an optional local LED indicator can be specified.

The fire system red versions of the new enhanced units are EN54 part 11 compliant, are fitted with a high intensity LED indicator and are supplied ready-fitted with 470 Ohm, 680 Ohm resistors and a protective diode, making them compatible with the overwhelming majority of conventional fire panels on the market. Resistor selection is a user-friendly process during installation. As standard, every unit is shipped with a resettable element fitted; a break glass is also supplied, as are two operating keys. Switching from resettable to break glass operation is a simple procedure of replacing one operating element with another.

For use in security, process control, emergency door release and other non-fire applications, the key-resettable units are available with white, yellow or green bodies. Single or double pole versions are available and all commonly used switch monitoring configurations are user-selectable in the one device.

All devices are supplied complete with a back box with cable entry for surface mounting. If flush mounting is preferred, the units will fit directly to electrical conduit boxes with standard mounting centres.

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Don’t forget Aspirating Smoke Detection!

“probably the most versatile detection technique available”

Many readers will have noticed that February’s article in IFP reviewing Detection Techniques was incomplete in that it failed to include Aspirating Smoke Detection (ASD) – a technology which, according to the I&I-Proplan survey of the European Fire Detection Market,[1] accounts for 7% of the market value across Europe! In some territories, notably the UK, the proportion was significantly higher.

By Peter Massingberd-Mundy

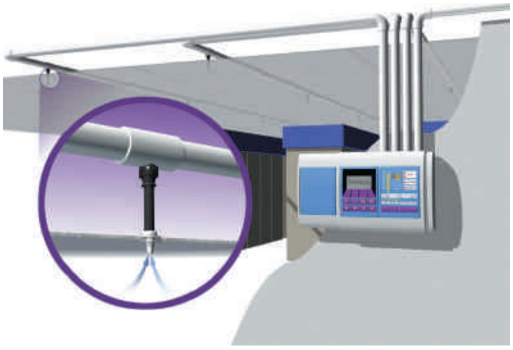
Vision Systems Europe Ltd

The fact is that ASD is a mainstream, well-proven and widely used detection technique. Many journal articles are available covering the diversity of applications for ASD but this article concentrates on the increasing importance of product standards, approvals and audits and also the codes of practise, which aim to ensure that the good reputation of the technique is maintained. The article culminates in a very simple 5-point checklist.

The cumulative effect

The principle of ASD is very simple. Smoke samples are drawn into a central detector through sampling pipes and holes as illustrated in the figure overleaf. The conservative approach to ensuring that the detection performance of any particular ASD system meets minimum requirements is to demonstrate that the detection performance of a single hole is equivalent to a standard EN54-7 point detector. Essentially, when smoke from the standard test fires in EN54-7 enters a single hole the ASD must signal an alarm.

This is a good starting point for any system design as it recognizes that ASD systems must accommodate their inherent dilution characteristics whereby smoke entering one active hole is



diluted by clean air entering all the other holes. As such, the central detector must be many times more sensitive than a standard point detector to achieve the minimum necessary performance.

However, when viewed for a different perspective, this dilution effect is, in fact, one of the special benefits of an ASD system and gives it the ability to more reliably detect lower concentrations of smoke than a normal point detector – not only because the single central detector typically incorporates more advanced detection technology than a low cost point detector – but also because ASD systems effectively become more sensitive when smoke enters more than one sampling point. In any real fire scenario, it is highly unlikely the smoke will only enter one hole. As a result, ASD systems have a natural ability to detect "diluted" smoke in the space – the more dispersed or diffused the smoke becomes the more sampling holes it enters and the higher the effective sensitivity of the ASD becomes. This positive feature essentially reverses (overcomes?) the natural dispersion and diffusion of smoke in a volume and is often referred to as the cumulative effect.

Accurate prediction of response

Performance Based Design approaches are currently being successfully developed and refined to take account of this cumulative effect and accurately predict the likely response time of an ASD system in typical applications such as the protection of beam pockets, cold stores and high bay warehouses. However, it is beyond the scope of this article to elaborate on these developments.

Market perceptions

In the past, the High Sensitivity capability of ASD systems has been viewed with some suspicion and misleading claims that they are responsible for "many false alarms" have now been dispelled. The market leader now has over 250,000 laser based systems installed across the world – providing reliable and stable protection across a wide diversity of applications from very early warning in critical computing facilities and clean rooms to unusually dirty applications in flour mills and coal fired power stations – and many applications in between.

However, as with all maturing technologies, good reputations can be exploited. Competitive products emerge that may offer an attractive price and emulate the features of the established

products but their capability, stability, reproducibility and reliability often fall short of the anticipated performance. Hence the need for clear, unambiguous product performance standards such EN54-20.[2]

EN54-20 – product standard for ASD

This new standard encompasses the core requirements of EN54-7 in that all ASD systems MUST be capable of detecting smoke from the standard test fires (TF2,TF3,TF4 and TF5) while set up in a "worst case" configuration. However, the standard goes further and introduces a classification system and some new fire tests such that:

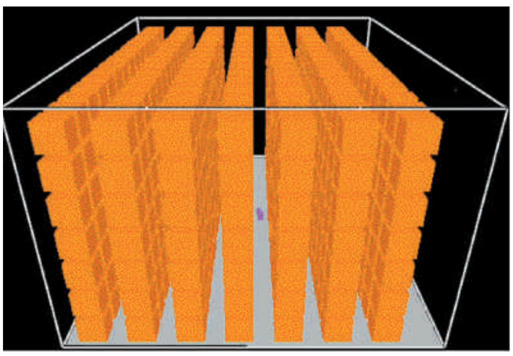
- an Enhanced Sensitivity ASD System (Class B) must detect a series of fires which produce about 13 times less smoke than the standard EN54-7 Fires and
- a Very High Sensitivity ASD system (Class A) intended for Early Warning applications must detect a series of test fire which produce about 40 times less smoke than the standard EN54-7 fire tests.

This new classification system will inevitably assist in the application of the most appropriate ASD system. Further guidance is provided in the BFPSA Code of Practice (CoP) for ASD systems[3] which has been updated to encompass EN54-20. This goes further than EN54-20 and introduces a technique for categorising any ASD system in terms of its sensitivity class, the method of sampling, the underlying drivers for using ASD and, most importantly the route to compliance – whether prescriptive or performance based. If the latter then the CoP. Has a number of performance fire tests which may be specified.

It is now only a matter of time for EN54-20, which passed formal voting at CEN in April 2006, to become harmonised under the Construction Products Directive and so become a mandatory requirement for all ASD systems intended for installation across Europe. There are some regions, including the UK, where EN54-20 may not be formalised into a *legal* requirement but in the majority of Europe it will be a legal requirement that any ASD system installed must meet the essential requirements of EN54-20.

CE marking

Under the Construction Products Directive, CEN TC72 has been mandated to produce the EN54 series of standards for all the mainstream fire detection products – from call points to flame detectors. Interestingly, while ASD systems are included under TC72's mandate, Video Smoke Detection (which was mentioned in the aforementioned IFP article on Detection Technologies) is not.



What this means is that ASD products will (from around 2009) be required to be tested by an independent test house (formally known as a "Notified body") before they can be CE marked and legally installed within the majority of the EU. Regulation of "emerging technologies", such as those mentioned is at a much earlier stage.

Once an ASD product has been successfully assessed to EN54-20 by a notified body the manufacturer is able to affix the CE mark and declare it compliant with EN54-20 under the CPD. Without notified body approval to EN54-20, the CE mark can only relate to other EU Directives such as the EMC Directive and Low Voltage Directive (LVD).

During the transition period (2006 to 2009) manufacturers may continue to sell unapproved product or continue to declare their products compliant with other prevailing European standards – of which there are only three in existence in Europe; CEA4022, NF S 61950 (France) and ONorm3014 (Austria). However, it is inevitable that between now and the end of the transition period, increasing numbers of ASD systems will be submitted for testing against EN54-20.

Ongoing quality assurance

While EN54-20 and the CPD will inevitable increase the quality and understanding of ASD systems the question of ongoing quality assurance remains an issue. Under the CPD, Fire Detection Products are required to have "Level 1 attestation". This means that the products must be type approved by a Notified body in order to carry the CE mark. Furthermore, under level 1 attestation, appropriate Factory Process Control (FPC) must be in place and undergo regular auditing by the Notified body. While this *should* ensure the ongoing quality and performance of manufactured product there is no requirement for the Notified body to independently the test the performance of manufactured product on a regular basis. However, some Notified bodies such as VdS, LPCB and CNPP require this regular product audit in order for a product to carry their particular "quality" mark.

It is almost inevitable that some products with marginal performance which can meet the requirements of type testing (in the case of ASD systems this includes testing of 8 samples for reproducibility) will struggle to meet ongoing auditing of performance and it is not unknown for Product approvals to be withdrawn on account of failures during product audits. It is therefore a good idea to check the current status of a products approval prior to each purchase. This is easily done by visiting their "real-time" website or consulting their product catalogue. For example LPCB maintain a list of news of product approval at www.redbooklive.com.

5 points to consider

1 Clearly define the intent and route to conformity for each and every ASD project. The BFPSA CoP provides a useful categorisation technique to support this.

2 Ensure that the ASD product you select has the appropriate capability – i.e. that the sensitivity class (considering pipe length and number of holes) is sufficient to meet the project objectives.

3 Check that the specific ASD product selected has the necessary approvals.

4 Require that the installation is done in accordance with normal practise. For example that it is done in line with the recommendations of the BFPSA CoP.

5 Finally, ensure that a maintenance plan is in place and that the results of commissioning tests are recorded for reference during future maintenance.

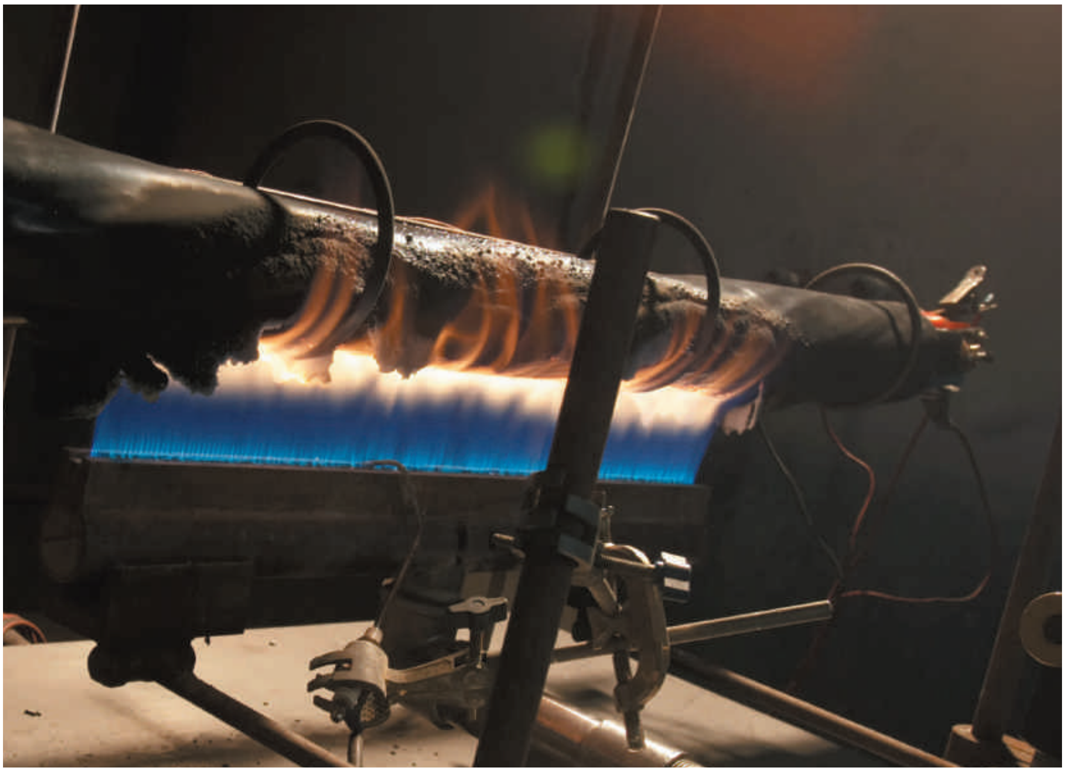
By following these five steps you can be confident that the ASD system will perform to the objectives defined. IFP

References

1 I&I Proplan Study European Fire Market 2003 – 2008 www.iandi.ltd.uk

2 EN54-20 Fire detection and fire alarm systems – Part 20: Aspirating smoke detectors

3 British Fire Protection Systems Association (BFPSA) Code of Practise for the Design, Installation, Commissioning and Maintenance of Aspirating Smoke Detector (ASD) Systems. www.bfpsa.org.uk



Fire rated cabling:

Making the right decision

Every fire detection and alarm, emergency lighting and public address installation must display one indispensable characteristic if they are to deliver their expected performance – the system must have integrity. To achieve this, it is essential that the cabling functions as the installation's designer intended. Here, David Oldfield overviews the latest developments in fire rated cabling and addresses a number of issues that still need to be more fully understood by specifiers and installers alike.

By David Oldfield

Product Development Manager at Draka UK

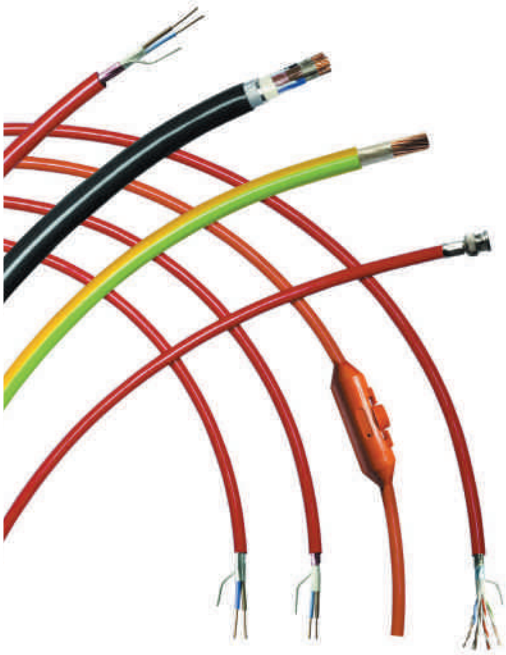
As the latest revision of UK legislation relating to the fire performance of fire alarm cables has now been around for a few years, the majority of specifiers and installers are familiar with the main requirements. However, the availability of an increasing number of cables on the market, coupled with an awareness – in England and Wales – of the need to adopt what might be described as "best practices" when the new Regulatory Reform (Fire Safety) Order is enacted later this year means that it is high time for a number of issues to be finally resolved.

So, what needs to be addressed? Certainly it is essential to move quickly to a point where specifiers and installers can confidently rely on manufacturers' cable ratings; cable fixing needs to be consistently undertaken to a higher standard; manufacturers' recommendations regarding the bending of cables must be adhered to, and cable jointing needs to be undertaken to a standard that does not potentially impair the installations' integrity.

But first, before turning to these issues, let us take a brief look at some of the latest fire performance cabling solutions that have come onto the market in the past few years.

New cable solutions

In the UK, fire performance cables for alarm systems now fall into two categories: Standard and Enhanced; performance levels that are determined by testing procedures described in BS EN 50200: 2000 and BS8434: 2003. Standard cable is acceptable for the majority of installations, whereas Enhanced cable is required in clearly prescribed applications. These are: buildings where cables are required to operate longer due to phased evacuation; buildings over 30 metres high that are not protected by sprinklers; buildings with critical signal paths to areas where people may remain for some time during a fire; and buildings where a fire risk assessment identifies the need for enhanced performance.



The demand for Enhanced cables is on the increase, possibly fuelled by the growing international trend for buildings to be designed on fire safety engineering principles, rather than prescribed measures. In England and Wales, this trend is likely to be further boosted in the wake of the Regulator Reform (Fire Safety) Order. This has resulted in a number of major investment programmes that have seen the introduction of pliable cables that attain Enhanced performance.

This new generation of Enhanced fire performance cables includes Draka UK's recently upgraded, award-winning Firetufplus Enhanced cable that was introduced in 2003. It offers 60 minutes fire and mechanical protection, followed by 60 minutes of fire, mechanical impact and water protection. In common with all Draka UK's Firetuf cables, its performance is verified by BASEC and LPCB independent testing and approval. Firetufplus Enhanced is available in long lengths and has a twisted core construction to improve signal clarity. It is suitable for use in Zone 1 and Zone 2 hazardous areas, is easy to handle and install and has low termination costs.

The Draka UK Enhanced offering also includes Firetuf Data, which combines high-frequency data transmission with circuit integrity in one-pair, two-pair and four-pair cables that will continue to transmit data even when the cable is being directly attacked by fire.

Strip for easy installation

Among the latest crop of developments is a cable that has been widely welcomed by contractors for its ease of preparation, handling and installation. The new Firetuf Easystrip zero halogen, low smoke alarm cable combines robust construction with the fastest ever sheath removal. Installation and preparation damage of the BASEC and LPCB tested and approved cable is minimised with the utilisation of a filled supportive sheath, in place of the weaker hollow constructions. It is a pliable alarm cable that is not prone to deformation and kinking, even when the cable bending radius is tight, which meets the Standard performance of BS5839-1 and BS5266-1 – the Code of Practice for emergency lighting.

Firetuf Easystrip exploits the very latest materials technology to deliver the ultimate in flame retardancy and consistent circuit integrity, setting a new international industry benchmark for competitive products in terms of flame spread and smoke production, lightness and reduced diameter. Easystrip also has a twisted core construction for improved signal clarity and is also suitable for use in both Zone 1 and Zone 2 hazardous environments.

Compatible protection

Another recent innovation was the introduction of a cable specifically designed to meet the challenging demand for immunity to electro-magnetic interference [EMI]. This is a particular requirement of airport environments where higher than normal levels of electro-magnetic radiation are present, rendering fire detection and alarm systems vulnerable to false alarms.

The problem was resolved with the introduction of Firetuf EMC, which has since been specified for the integrated fire alarm, voice alarm and public address system for Europe's largest current construction project, the new Terminal Five at London's Heathrow Airport. It is a Standard grade cable that offers increased immunity to electromechanical interference, and is suitable for use in both Zone1 and Zone 2 hazardous areas. It also shares many of the premium-build specification features of other Firetuf cabling solutions, notably availability in long lengths, ease of handling and installation, and lower termination costs.

Resolving outstanding challenges – cable ratings

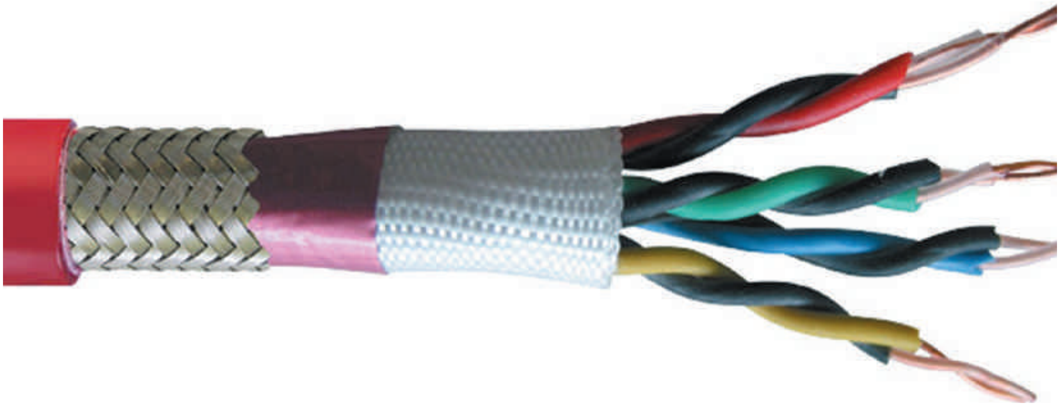
Following the introduction of the Standard and Enhanced classifications, there have been a number of instances of incorrect product installation. Whether due to misunderstanding the cable performance rating, or because cables are marked with a rating that testing subsequently proves to corroborate is difficult to say.

Whichever, the only way of ensuring that these instances cease to exist is through third party accreditation, a policy that Draka UK has been championing in the cable industry for some years. Specifiers should also seek direct evidence of independent approval, such as listing in Part 3 of Volume 1 of the LPCB Red Book. There is also a strong case for approval bodies of the stature of BASEC and the LPCB to carry out routine sampling inspections to ensure that certified standards are maintained.

Installing problems

Correctly securing the cables is a vital part of any installation, as every part of a cable system's critical signal path, as well as the low voltage mains supply to the system, must resist the effects of fire. In the absence of definitive guidance, it is important to follow the cable manufacturers' recommendations. Alarmingly though, it is still possible to find instances – thankfully few – where plastic ties and plastic trunking have been used as the sole means of cable support.

The spacing of cable fixings is another issue where close adherence to the manufacturers' guidelines is vital. Cables can be fixed directly to a



surface using metal 'P' clips and, where cable is fastened to trays – especially to the underside – stainless steel cable ties must be used. However, these requirements result in significant installation costs and fixing distances that are being queried by contractors. The point that installers must remember though is that the cable system has been tested using fixing distances and clips as recommended by the manufacturer and any deviation may put at risk the level of fire survival.

Bending the rules

Another important stipulation that is sometimes flouted is the selected cable's minimum bending radius. Typically, manufacturers recommend six-times the cable's diameter, a formula endorsed by Annexe A5 of BS7629. However, some manufacturers suggest a minimum of eight-times, and even this is exceeded in some installations and an Enhanced cable has been found to have been bent at 90 degrees.

Some cables with a hollow construction are particularly prone to kinking and potential rupture when subjected to this degree of abuse, while others have a more robust construction and are capable of use at three-times the cable diameter without sustaining damage, in accordance with the BS7540 minimum recommendations. It is vitally important though, if subjected to excessive bending, that it can be demonstrated that cables can retain their circuit integrity, since they are tested at six-times the cable's diameter.

Alarming joints

In the UK, BS 5839-1 allows for joints in alarm cables as part of the installed system, as a cable system is deemed to comprise the cable itself, the means by which the cables are secured, and the means by which the cables are jointed. The standard states that cables should be installed without external joints wherever practicable, and that all terminations and other accessories should be such that they minimise the possibility of early failure in the event of fire. Other than in the case of joints at or within system components – such as control equipment, manual call points, fire detectors and sounders – terminals should be constructed of materials that will withstand a similar temperature and duration to that of the cable.

Clearly, there is a need to understand the definition of the word "joint". The standard defines it as a means of joining two cables in a through joint, so as to preserve the critical signal path. All other terminations fall into what are classified as "devices". The need to seek manufacturers' guidance regarding the performance of joints, therefore, also applies to assessing the behaviour of jointing practices in order to demonstrate that they are capable of withstanding a similar temperature and duration.

The cable industry has considered this requirement and prepared a draft proposal for the testing of joints, and an initial survey in the UK via the Contractor's Associations concluded that joint boxes for fire systems needed to be metal with steel fixings, coloured red, marked "fire alarm'", and contain a ceramic terminal block.

In reality, surveys of installations suggest that joints are made up in-situ from boxes, glands and terminal blocks, albeit that purpose-manufactured boxes are available. Furthermore, preliminary testing has demonstrated that certain jointing practices with some cable designs, fall far short of the corresponding cable rating. As a result, specifiers and system designers should require manufacturers to demonstrate compliance of their jointing procedures, so as not to compromise the integrity of the overall installation.

The way forward

The specifier and installer now has available the widest ever selection of fire rated cabling options. They are also increasingly aware that cable integrity is indispensable if fire detection and alarm systems are to be relied upon to operate to their design expectations in an emergency.

However, to ensure the robustness and reliability of an installation, greater care needs to be taken to make sure that the cable selected is the most suitable for the job, and that it meets the required standard. Hence, specifiers, system manufacturers and installers should insist on independent, third party verification from established approval bodies.

There must also be greater attention paid to the fixing and jointing of cables. Installation contractors need to ensure that site staff appreciates the importance of adopting the correct techniques and materials, and provide them with the necessary training. Specifiers and project managers should always keep a watchful eye to ensure that manufacturers' recommendations are adhered to when it comes to fixing spacing and cable bends. This is perhaps particularly so in concealed or out of the way areas that might be difficult to access once installation is complete for, who knows, this might just turn out to be the entire installation's Achilles Heel. IFP

David Oldfield is Product Development Manager at Draka UK and has been involved in the design and manufacture of electric cables for the past 35 years.

FIRE PROTECTION – THE IMPORTANT THIRD!!

By Graham Ellicott

Chief Executive, Association for Specialist Fire Protection (ASFP)

Third party accreditation, the third man and the third way. Do you know the difference? Which one is associated with Harry Lime, which with Tony Blair and last but not least, which is **not** associated with either of the other two?

You might have thought the question easy. I mean, of course, zither music and post war Vienna are obviously not Tony Blair as he's not old enough, is he? On top of that, Tony Blair is a real person and Harry Lime is a figment of Graham Greene's imagination that was brought to life in the cinema by Carol Reed. But what was the name of the movie?

Enough of the confusion. Harry Lime was the recently dead guy in the film-noir classic 'The Third Man' and Tony Blair is an adherent of 'The Third Way' in politics.

You may ask why the aforementioned diatribe has been included. Well, it serves to illustrate the extent of the confusion in the construction market when it comes to the remaining 'third' item – 'Third Party Accreditation'

The ASFP assumed, perhaps naively, that most people in the construction industry understood the concept of third party accreditation for installers of fire protection systems. However, a survey carried out by the ASFP contractors' committee found that there was a lot of confusion in the market and in particular, from the main contractor and property developer base. Thus, its time for a basic course in the nomenclature!

You may well ask why the market should have any knowledge of the term? For that answer turn to 'Approved Document B' (ADB) of 'The Building Regulations 1991 – 2000 Edition' which says:

'Since the performance of a system, product, component, structure is dependent upon satisfactory site installation, testing and maintenance, independent schemes of certification and registration of installers and maintenance firms of such will provide confidence in the appropriate standard of workmanship being provided.'

And….

'Third party accreditation and registration of

installers of systems, materials, products or structures provide a means of ensuring that installations have been conducted by knowledgeable contractors to appropriate standards, thereby increasing the reliability of the anticipated performance in fire.'

In addition, the ASFP was especially encouraged to see the following proposed wording in the recent ADB consultation document with regard to third party accreditation schemes for the installation of fire protection systems:

'Schemes such as those mentioned above may be accepted by Building Control Bodies as evidence of compliance. The Building Control Body will, however, wish to establish, in advance of the work that the scheme is adequate for the purposes of the Building Regulations.'

The 'management contracting' construction process sees the client and their architect 'loosen' their control over the design and the construction of the building and under 'design and build' this 'loosening' can be further extended.

The Association for Specialist Fire Protection (ASFP) strongly believes that these statements from ADB are the 'best practise' that the construction industry should be striving for to ensure the highest level of fire safety of the UK's buildings. Indeed, all ASFP installer members are third party accredited or working towards third party accreditation.

So where does the market's confusion come from? Well, many respondents to the survey thought that approved or recognised applicators, as appointed by product manufacturers, were in fact third party accredited! This is not of course to say that product manufacturers don't train their installers properly, but such training does not extend to them randomly inspecting the installed product on-site!

Some other companies that replied to the survey thought that the carrying of CSCS (Construction Skills Certification Scheme) Cards by the operatives meant that their company was third party accredited. CSCS aims to register every competent construction operative within the UK not currently on a skills registration scheme. Operatives will get an individual registration card (similar to a credit card) which lasts for three or five years. The CSCS card also provides evidence that the holder has undergone health and safety awareness training or testing. The CSCS initiative is supported strongly by the ASFP, but the scheme registers operatives and not companies and does not provide any inspection of work or company systems.

The ASFP has been heavily involved with the Construction Industry Training Board (CITB) in the design of the Level 2 and 3 NVQs in Passive Fire Protection. Level 2 is for installation operatives and Level 3 for supervisors. These NVQs demonstrate the competence of the employee and this is assessed by on-site visits. It is the latter that has led to the confusion in some quarters that these constitute some sort of accreditation/inspection – **it does not!** This NVQ demonstrates that the holder has been assessed to have a basic competence level in at least two out of the seven possible fire protection modules. The seven modules currently include the application/installation of structural cladding, intumescent coatings, fire rated ductwork, fire stopping and penetrations/cavity barriers, fire rated walls and linings, fire rated ceilings and spray applied materials. The NVQ is a valuable tool in looking at the competence of a company's workforce but it does not ensure that the work on-site will be of the standard required by the client.

So, we've looked at what third party accreditation is not, so what is it?

In the opinion of the ASFP third party accreditation schemes mean a combination of site inspections, quality management system audits plus the assessment of the competence of the workforce. Such schemes ensure that passive fire protection installations have been conducted by knowledgeable contractors to the appropriate standards. In addition, these schemes offer a meaningful certificate of conformity that is backed by a third party (the scheme organiser) and this will add confidence to the client that the passive fire protection in his/her building has been installed properly. Given the increased responsibilities of the 'Responsible Person' under the up and coming Regulatory Reform (Fire Safety) Order, it would seem sensible for them to insist upon the use of third party accredited installers for the passive fire protection in their buildings.

So, remember there is no space for naivety or confusion in the installation of passive fire protection. It's a life safety item and as such, in the opinion of the ASFP, should be installed by a third party accredited installer.

Given that 60-70% of commercial construction has Government money involved, shouldn't the Government be leading the way when it comes to best practice in the construction of buildings?

The Third Man won an Oscar for cinematography. Tony Blair and the 'Third Way' have won three General Elections. Surely now it's time for 'Third Party Accreditation' for installers of fire protection systems to win through in the minds of the main contractor and the property developer?

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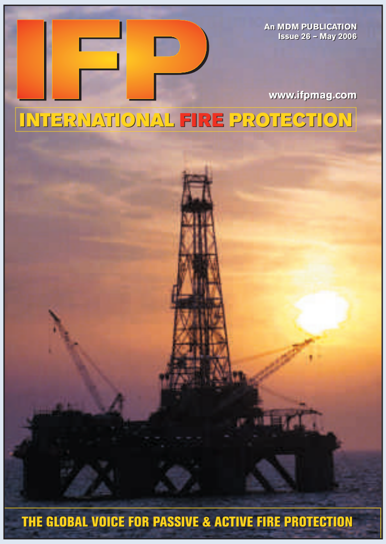

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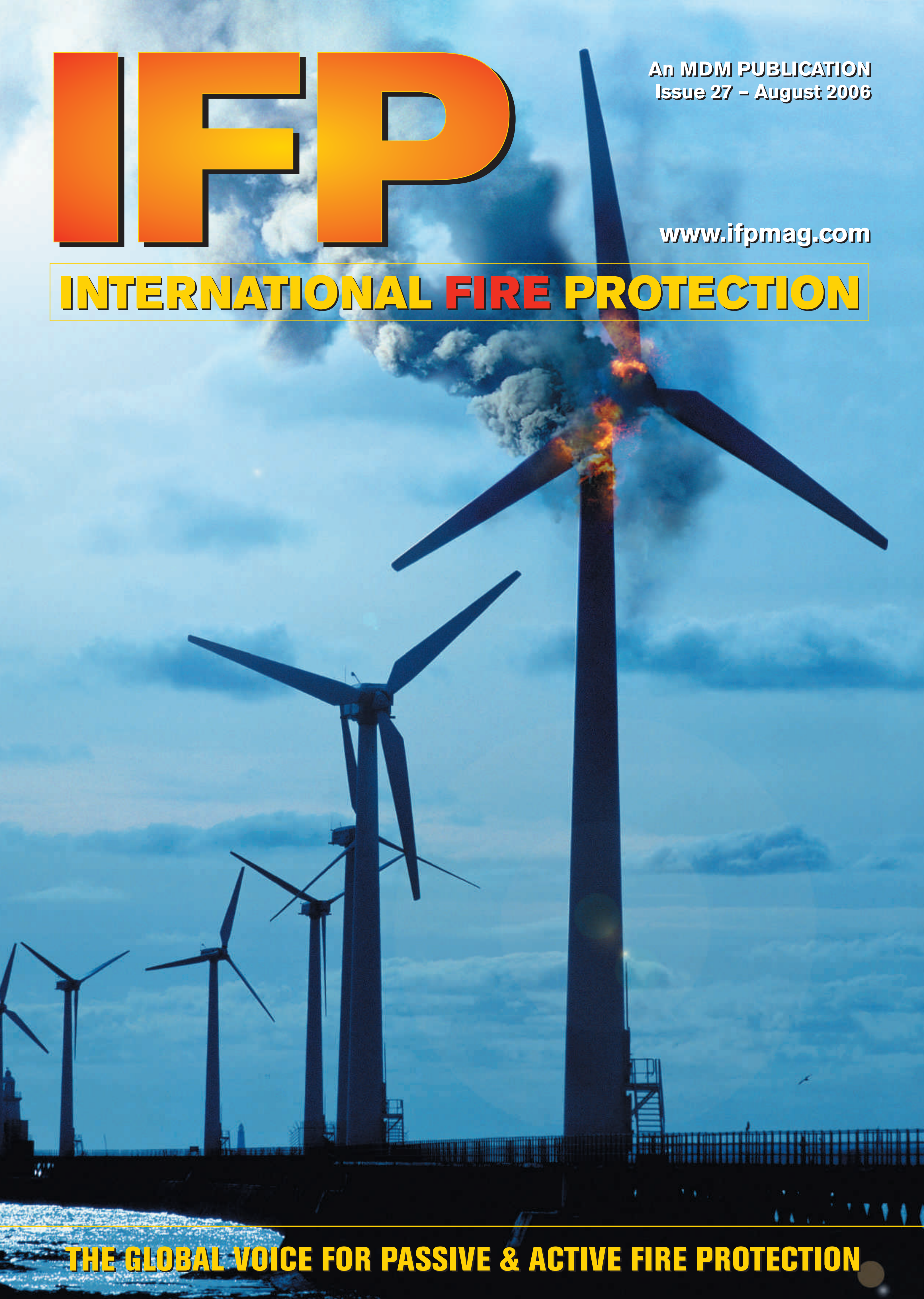

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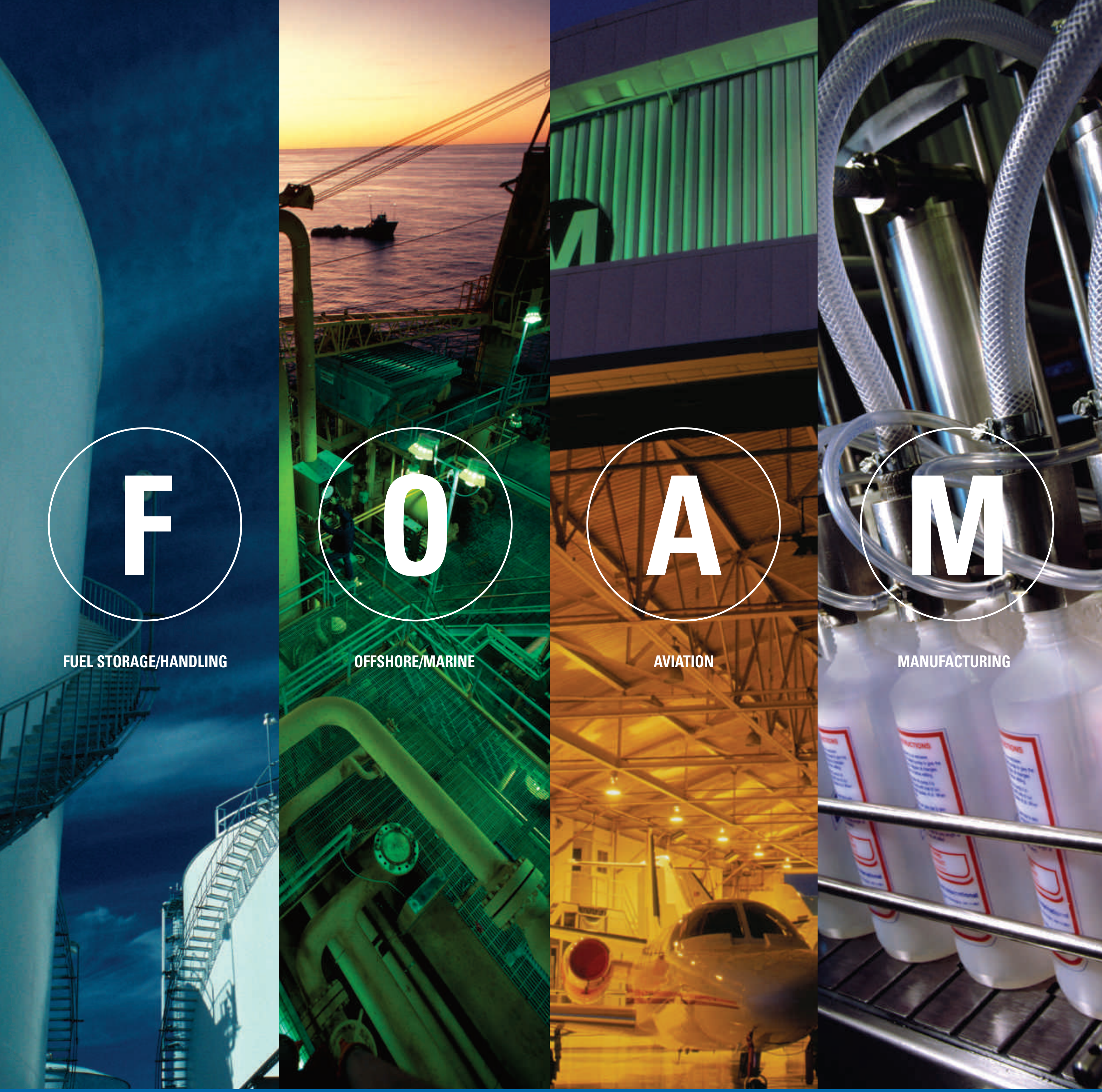
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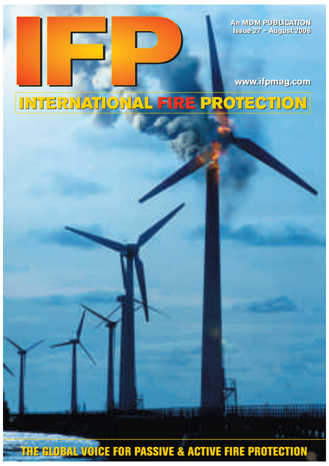

Front Cover Picture: WIND TURBINE FIRE. Pic courtesy of Danfoss Semco. © Danfoss Semco

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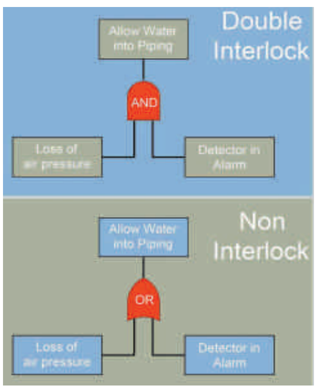

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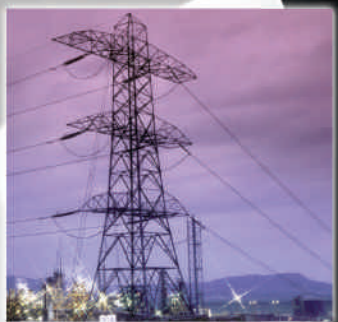
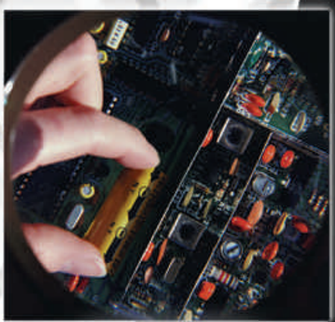
TECHNICAL SUPPORT

FM-200®
3M™ NOVEC™ 1230



CO_2 HIGH & LOW PRESSURE



WATER MIST

ARGONITE

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Across borders and across industries, Chemetron is the single source solution for integrated fire suppression systems that meet today's needs and tomorrow's changing requirements.

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Fire Systems™

A UTC Fire & Security Company

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Matteson, IL 60443-2254 U.S.A.
Phone: (+1) 708.748.1503
Fax: (+1) 708.748.2847
Website: www.chemetron.com
E-mail: info@chemetron.com

Kidde offers full range of Clean Agent Systems

KIDDE FIRE PROTECTION now offers the most extensive range of clean agent fire suppression systems designed for use with 3M™ Novec™ 1230 Fire Protection Fluid. Kidde Fire Protection is part of UTC Fire & Security, a unit of United Technologies Corp. (NYSE:UTX).

The Novec 1230 fluid systems are designed to protect critical high-value assets from fire with minimal down-time and clean-up costs. Typical applications include telecommunication switch rooms, computer and electronic control rooms, and aboard ships. They are the latest addition to the company's wide range of clean agent systems that includes FM-200, Argonite and Carbon Dioxide.

The company has invested in the new systems because it believes Novec 1230 fluid represents sustainable, long-term technology that meets both today's environmental regulations and those in the foreseeable future. It has a low Global Warming Potential (GWP) rating of just one, an Ozone Depleting Potential (ODP) of zero and a low atmospheric lifetime of only five days.

Kidde Fire Protection offers three different Novec 1230 fluid systems to suit a wide variety of applications. A standard 25 bar system for industrial applications, a specialist 25 bar marine system and a 42 bar system that offers increased design flexibility for larger or more complex facilities.

All the systems are European TPED (Transportable Pressure Equipment Directive) and PED (Pressure Equipment Directive) compliant and manufactured to ISO 9001:2000 standards. The 25 bar industrial system is approved by Underwriters Laboratories (UL) and FM Global, while the 25 bar marine system is Marine Equipment Directive (MED) compliant and approved by ABS, Lloyd's Register and DNV. The 42 bar system is approved by VdS.

Novec 1230 fluid is stored as a liquid and discharged into the hazard zone by specially designed nozzles as a colourless, non-conductive and non-corrosive gas. It puts fires out quickly by reaching its extinguishing concentration in 10 seconds or less and then absorbing heat from the fire. It has the highest heat capacity of any commercially available chemical suppression agent, giving it the lowest extinguishing concentration of 4 to 6 percent.

In occupied spaces at normal design concentrations, Novec 1230 fluid presents no risk to personnel. US EPA SNAP has classified it as acceptable for use as a total flooding agent in occupied spaces. It provides a safety margin of nearly 100 percent, which is by far the largest safety margin of any clean fire suppression agent available on the market today.

The new technology is supported by Kidde Fire Protection global sales, technical and customer service resources. Systems are designed by specially trained and certified engineers using hydraulic calculation software that optimises performance while minimising installation costs.

This latest announcement reinforces the position of Kidde Fire Protection as the market leader in clean agent fire suppression system technology. Since pioneering their development more than 10 years ago the company has supplied several thousand chemical and inert gas systems world wide.

Kidde Fire Protection manufactures clean agent fire suppression systems at Bentham, North Yorkshire, and electronic fire detection and alarm equipment at Peterlee, County Durham. It provides product sales and customer support from Thame, near Oxford. Kidde Fire Protection is part of UTC Fire & Security, a United Technologies Corp. business unit that provides fire safety and security solutions to more than one million customers around the world. UTC Fire & Security is headquartered in Connecticut, USA.

3M and Novec are trademarks of 3M Company.

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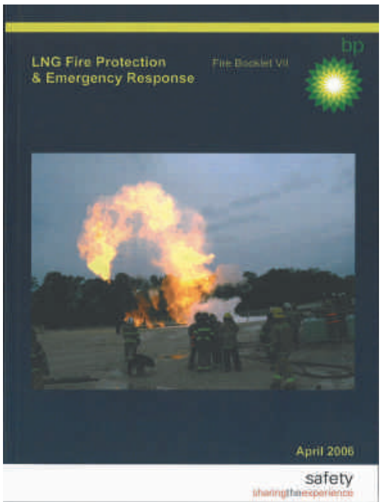
From the Editor

May Issue *IFP* – Issue 26

In my article 'Testing and Assessment of Fire Stopping and Penetration Sealing Systems: The British Regime' in the May Issue of IFP on page 56, para 2, line 3 states "the likely effect on fire performance must be evaluated. **This is normally conducted via an assessment report provided by a UKAS accredited test laboratory**"
In fact this should say **"This is normally conducted via an Assessment Report provided by a UKAS accredited test laboratory or by competent authority/persons appropriate to the complexity of the evaluation undertaken"** – *Graham Ellicott ASFP*

Furthermore:
The pictures used in this article should have been accredited to Rectorseal® and their Metacaulk® product range. We thank them for letting us use their photography and apologise for this omission.

New BP Booklet features Angus Foam Technology for LNG Applications



ANGUS FIRE have announced that BP, one of the world's largest energy companies, will feature Angus' specialist fire fighting foam equipment in a new booklet on extinguishing liquefied natural gas (LNG) fires. Angus Fire is part of UTC Fire & Security, a unit of United Technologies Corp. (NYSE:UTX).

The booklet, titled "LNG Fire Protection & Emergency Response," is set to become the industry standard on LNG spill and fire protection. It explains the dangers of LNG as well as the special fire hazard management and emergency response measures required in the event of an LNG fire.

"Until now the only fire test data available on LNG has been based on outdated storage and handling techniques," said Mike Willson, Product Manager for Angus Fire. "This new booklet describes modern solutions for realistic operating conditions, and is all the more important because global demand for LNG as an energy resource is growing rapidly."

The booklet's recommendations are based on extensive testing of the effectiveness of different types of foams and application techniques in a range of realistic LNG emergency scenarios. The tests were carried out at the new LNG testing and training facility developed and sponsored by BP in collaboration with the Emergency Services Training Institute at Texas A&M University.

The booklet describes how a good quality high expansion foam applied at a controlled rate and expansion ratio is highly effective in reducing vapour levels at LNG spills and in achieving rapid and dramatic reductions in the heat emissions of LNG fires.

Only specialist high expansion foam generators and foam concentrates that have been proven to withstand the intense heat of LNG fires should be used, such as the Angus Fire LNG Turbex generator and Expandol foam that are both featured in the booklet.

Company experts recently addressed the LNG Technical Committee at the National Fire Protection Association World Safety Conference in Orlando and the Society of International Gas Tanker and Terminal Operators (SIGTTO) AGM in Athens. SIGTTO is the world's leading LNG safety organization and represents virtually the entire world's LNG tanker and terminal operators.

Angus Fire is also co-operating with Resource Protection International, the independent fire protection consultancy appointed by BP Group Technology to prepare the new booklet, in establishing a new LNG fire training programme for SIGTTO in Europe.

The new booklet is the seventh in the BP Fire Booklet Series ("blue books") and is available from BP International.

For more information contact:
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Email: jon.brittain@kiddeuk.co.uk

New C-tec Research and Development Facility

C-TEC's state-of-the-art Research and Development facility in the heart of Lancashire is now complete. The new Centre of Excellence in Mawdesley features three new laboratories and an extensive array of meeting rooms and customer demonstration areas. The official opening was timed to coincide with the company's 25th birthday celebrations.

Comments Andrew Foster, C-TEC's MD, 'The construction of this new facility marks a turning point for C-TEC as it will signal a significant increase in our research and development capabilities. The purpose-built environment and additional space will enable the company to investigate new technologies and we are now actively recruiting to expand our engineering staff'.

C-TEC's reputation as manufacturers of top-quality fire alarm control panels, voice alarms and disability equipment has resulted in the company enjoying considerable year-on-year growth.

The company's ambitious expansion plans also include a new 15,000 sq ft unit at its Wigan site to increase stockholding capacity and to accommodate two new surface mount assembly machines.

For more information contact C-TEC's marketing department on +44 (0)1942 322744 or visit www.c-tec.co.uk

Ginge-Kerr

Argonite

Argonite inert gas fire suppression systems from Ginge-Kerr are used extensively around the world to protect high value assets. Ginge-Kerr is part of UTC Fire & Security, a unit of United Technologies Corp. (NYSE:UTX)

Clean Agent Technology

Argonite is ideal for protecting business-critical computer and telecoms rooms, and also precious artefacts in archives, museums and art galleries. It gets organisations back to normal quickly with minimal damage, disruption and clean-up costs. It does not cause collateral damage to whatever it is protecting from fire because it does not leave behind any water or particulates.

Naturally Superior

Argonite is an inert gas blend consisting of a 50:50 mixture of the two gases Argon and Nitrogen that occur naturally in the atmosphere. With zero Ozone Depletion Potential (ODP), zero Global Warming Potential (GWP) and zero atmospheric life time, Argonite has excellent environmental credentials.

High Performance

Argonite is effective against fires in almost all combustible materials and flammable liquids. It works by displacing oxygen from the atmosphere and reducing it from the normal 21% to a level below 15% that will not support combustion. A typical design concentration of 40% will reduce the oxygen level to 12.5% within 60 seconds.

Low Space Requirement

Argonite systems consist of one or more cylinders, usually at 300 bar pressure, connected via a common manifold. System actuation can be manual or automatic and the gas is distributed through a pipe network and enters the protected area through special discharge nozzles.

A range of cylinders is available offering a choice of fills and pressures. The latest LPCB approved systems with cylinder storage pressures of 300 bar offer 30% space savings over previous 200 bar systems. The cylinders are mounted in rows and may be stored in any suitable location, even over 100 metres away from the protected areas.

If more than one area in a building needs to be protected, then a single Argonite system, designed to protect the largest room, can be used, with automatic valves directing the appropriate amount of Argonite into the required protected space. Provided that there is a low risk of more than one fire in the facility at any one time, this can provide significant cost and space savings.

Reliable & Affordable

Ginge-Kerr has over ten years design and installation experience. Factory trained and certified design engineers offer flexible design packages for the most cost-effective fire protection solutions. System design, the quantity of gas used, together with computer calculated pipe and nozzle dimensions ensure that the correct amount of Argonite is released effectively.

The Argonite system has been tested and approved by independent regulatory bodies throughout the world. In addition, system components are manufactured in accordance with ISO 9001:2000 Quality Management System and comply with all relevant legislative requirements such as US DOT and EU Transportable Pressure Equipment Directive (TPED) for cylinders and Pressure Equipment Directive (PED) for pressure components.

Argonite systems have low recharge and maintenance costs. The cylinder valves are designed to ensure reduced pipe sizes and low installation costs as well as optimum system performance. The valve design also allows a worldwide network of distributors to re-charge the cylinders easily without the need for replacement parts.

Global Reach

Argonite systems have a proven track record of success with more than 15,000 installed worldwide since 1993. Originally manufactured in Denmark, they are today produced at a new advanced fire suppression system facility at Bentham in the UK. System design and customer support is provided from Thame, near Oxford, with a world wide network of factory trained distributors. Ginge-Kerr is a UTC Fire & Security Company, which provides fire safety and security solutions to more than one million customers around the world. UTC Fire & Security is headquartered in Connecticut, USA. IFP

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Email: general.enquiries@kiddeuk.co.uk

Danfoss Semco:

A new power in fire suppression

Danfoss and Semco Maritime fire fighting department have joined forces to form a new mutual company named Danfoss Semco A/S Fire Protection. A technical design, production and installation contractor for the oil and gas, shipbuilding, food and pharmaceutical industries, Semco also develops fire-fighting systems. While, with a turnover in excess of €2 billion, Danfoss is a major manufacturer within the Refrigeration & Air Conditioning, Heating & Water and Motion Controls industry and the major shareholer in the new company.

By Mads Warming

Managing Director
Danfoss Semco

Danfoss Semco will take over the responsibility for the development and production of Semco's fire fighting systems. By combining Danfoss' research and development, management and manufacturing capabilities with Semco's technology, Danfoss Semco will ensure a growing share of the marine industry and create new opportunities for high-pressure water-mist fire suppression technology in the fast growing land-based market.

Marine-based fire suppression

Semco Maritime fire fighting department is one of the world's leading suppliers of fire suppression technologies – including high pressure water mist and CO_2 – to the marine industry. For the last 14 years the company has pioneered the use of high-pressure water mist and with the creation of Danfoss Semco this technology can continue to develop. By combining Semco's existing expertise with Danfoss nozzle technology, we can secure the future of water mist technology and further improve its price/performance ratio.

Our expertise means that Danfoss Semco can offer fire-fighting systems throughout the marine industry. From exposed sites such as car decks and heli-pads, to engine rooms, kitchens and accommodation decks, our goal is to always have two alternative systems for all areas. This is the only way to ensure that the solution is always the right one for the client. Being able to deliver a complete fire-protection system reduces servicing costs for the owner but it also saves time and money during the building process. Work on the boat or rig can be scheduled around one rather than numerous suppliers and any complications or queries can be dealt with immediately via a single point of communication and support.

Land-based fire suppression

From complex fire suppression systems for universities to industrial applications for the food manufacturing and wind turbine industries, Semco is already making successful inroads into land-based fire protection with high-pressure water mist. At the same time Danfoss continues to cement its position as the world's leading manufacturer of nozzles. Danfoss Semco will be able to exploit this nozzle technology as well as Danfoss' enviable research and development and manufacturing capabilities in order to develop and implement fire protection solutions for other land-based industries. All of which creates the ideal foundation for a very exciting future. IFP

Danfoss
Founded: 1933
Employees: more than 18,000
Business areas: development and production of mechanical and electronic components for several industrial branches within refrigeration & air conditioning, heating & water and motion controls
Presence: 53 factories in 21 countries
110 sales companies in 57 countries
Website: www.danfoss.com

Semco Maritime
Founded: 1945
Employees: 900
Business areas: technical contracting comprising design, production, installation and service for the oil and gas industry, the shipbuilding industry, the food industry and the pharmaceutical industry.
Presence: Branches in Denmark, UK, Norway and the USA plus representatives throughout the world
Website: www.semcomaritime.com


In Case of
FIRE
~~BREAK GLASS~~
RELAX

Fireloops solve seismic design challenges for fire sprinkler system in new American Airlines JFK terminal

Unique expansion loops allow simpler, tighter piping runs in New York terminal

Roof's wing design causes terminal to "take flight"

A 1,840,000 square foot behemoth that holds three complete concourses. Passenger check-in space big enough to hold Giants Stadium. A facility capable of accommodating 14 million passengers annually. Yet, the new American Airlines mega terminal at Kennedy Airport in New York pushed the envelope for designers, engineers and contractors who seemed to have less space to work with, not more.

By Zeke Bochenek

The Metraflex Company

Seeking to create clean, modern lines as well as functional space, architects challenged all disciplines to help them keep their vision. This meant squeezing utilities into as little space as possible, including a fire sprinkler system that met new seismic codes.

No room for traditional seismic joints

As a rule, seismic joints are not small, and not pretty. They require a convoluted Rube-Goldberg style arrangement of connections that would allow movement in all directions. "There was just no room for all that extra hardware," explained David McMahon, Senior Project Manager, SIRINA Fire Protection Corp. "Seismic codes are a relatively new issue in our part of the country, and to use the traditional grooved coupling configuration just would not cut it. That's when we found the Fireloops. They solved all our problems."

The unique design of seismic Fireloop expansion joints makes designing fire sprinkler piping runs a lot simpler. Capable of up to ±4 and ±8 inches of movement in all directions, Fireloops can fit snugly up in the ceiling, in walls, and can even be "nested" within each other, making them a more elegant and efficient solution for extremely tight piping runs.

"We installed dozens of Fireloops throughout the terminal in places I know we could not have used any other type of seismic joint," comments Rocco Abbate Executive vice President, SIRINA Fire Protection Corp. "The loops (Fireloops) solved a lot of issues.

"In fact, it was the first set of Fireloops we ordered that convinced us it was the right product," he continues. "They were so easy to install in the first phase of construction we knew it was the perfect seismic joint to use for the rest of the project."

What happens when it starts to fly?

The "wing-like" architecture of the terminal even created an interesting challenge. "We had to have some special Fireloops created that would accommodate up to 12 inches of movement and installed

Fireloops designed for 12 inches of movement were installed in the ceiling to allow for roofs movements of up to 5 inches upward and 1 inch downward

them in the ceiling at building separations," explains Tom Field, Eastern Region Sales Manager for Reliable Automatic Sprinkler Company, from whom SIRINA purchased the Metraflex Fireloops. "We needed extra movement and flexibility there because of the expected rise and fall of the facility from wind and snow." High winds across the wing-like roofline were expected to raise the roofline up to five inches. And the snow loading could cause the roof to deflect downward as much as an inch.

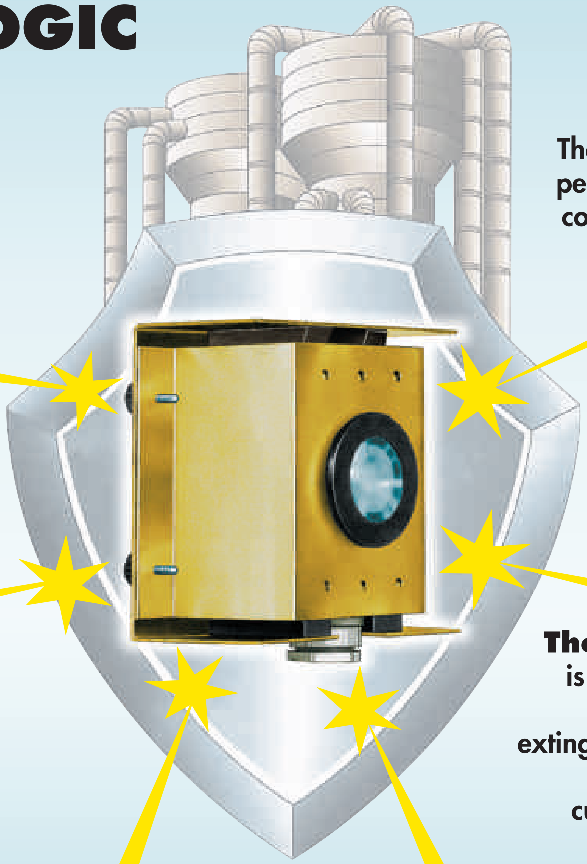
Fireloop expansion joints, developed and manufactured by Metraflex, have been used in thousands of installations in seismic applications nationwide. Their unique design provides the flexibility and freedom architects and engineers need to advance their designs. And the ease of installation and small footprint helps contractors speed through installations and meet construction deadlines and budgets.

The American Airlines terminal, which started in 1999, is a four-phase project slated for completion in 2007. The terminal will centralize ground access and passenger processing at JFK Airport. It will have 37 jet gates and 18 commuter gates, large customs and immigration halls, and a streamlined baggage system. IFP

Visit www.fireloop.info for more information, CAD downloads, pressure drop charts and other valuable information on designing with and installing Fireloops in a host of applications.
Or contact:
The Metraflex Company
2323 W. Hubbard,
Chicago, IL 60612
Tel: 312-738-3800
Fax: 312-738-0415
Email: info@fireloop.com

CONTROL LOGIC Spark detector

designed for dust collection systems to protect storage silos from the risk of fire.



Sparks fly at high speed.

They travel at a hundred kilometres per hour along the ducts of the dust collection system and reach the silo in less than three seconds

The CONTROL LOGIC SPARK DETECTOR is faster than the sparks themselves. It detects them with its highly sensitive infrared sensor, intercepts and extinguishes them in a flash. It needs no periodic inspection.

The CONTROL LOGIC system is designed for "total supervision". It verifies that sparks have been extinguished, gives prompt warning of any malfunction and, if needed, cuts off the duct and stops the fan.

ISO 9001

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BETTER *TO KNOW* IT BEFORE

Eye is faster than nose.

In the event of live fire
the IR FLAME DETECTOR
responds immediately

CONTROL LOGIC IR FLAME DETECTOR

the fastest and most effective fire alarm device for industrial applications

IR FLAME DETECTOR RIV-601/FA EXPLOSIONPROOF ENCLOSURE

For industrial applications indoors or outdoors where is a risk of explosion and where the explosionproof protection is required.
One detector can monitor a vast area and responds immediately to the fire, yet of small size.

IR FLAME DETECTOR RIV-601/F WATERTIGHT IP 65 ENCLOSURE

For industrial applications indoors or outdoors where fire can spread out rapidly due to the presence of highly inflammable materials, and where vast premises need an optical detector with a great sensitivity and large field of view.

Also for
RS485 two-wire serial line

ISO 9001

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CONTROL LOGIC s.r.l.

Focus in Syria – Nittan and Ess Company Win New Projects

The following systems were designed and installed by Nittan's ESI Preferred Partner – ESS Company:

MAGHAZEL FACTORY – EVOLUTION SYSTEM

This is a state owned textile factory in Damascus manufacturing cotton fabrics which are sold to manufacturers throughout Syria and overseas.

The Evolution system comprises a 13 Loop EVA-1 control panel monitoring over 1300 EV-PH Multisensor Detectors plus 60 Beam Detectors.

INTERNATIONAL SCHOOL – HOMS

Main entrance to International School – Homs

This is a newly built private school partly owned by the Syrian Cham Palace Hotel chain.

The Evolution system comprises of an EVA-1 control panel and repeater panel with 4 loops protected by EV-P Photoelectric Detectors. The school will be expanded later this year.

SEMIRAMIS HOTEL AT PALMYRA

The Semiramis Hotel is a brand new 5 Star hotel in Palmyra which is a major Syrian tourist attraction. Visitors from all over the world come to see the well preserved remains of a large Roman city.

Semiramis Hotel

The Sensortec fire detection system comprises of an FX20 addressable control panel with Sensortec Smoke and Heat detectors fitted throughout the hotel. The hotel plans to double in size over the next 12 months.

BLOUDAN GRAND HOTEL

The Bloudan Grand Hotel is a 5 Star hotel in the mountain resort town of Bloudan.

The Sensortec fire detection system comprises of Morley networked ZX control panels (2 x ZX5E panels in the main hotel building and 1 x ZX2E panel in the Leisure / Pool complex) with ST-P-AS Photoelectric and ST-H-AS Heat detectors fitted throughout the hotel.

Bloudan Grand Hotel

For more information contact:
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Tel: +44 (0) 1483 769555 Fax: +44 (0) 1483 756686 M: +44 (0) 7834 120836
Email: mhunter@nittan.co.uk
Website: www.nittaneurope.eu

Mosquito Crowd Dispersal System

COOPER MENVIER today announced that it has acquired, from inventor Howard Stapleton's company, Compound Security Ltd, the marketing and manufacturing rights to 'The Mosquito', a revolutionary crowd dispersal system.

Whilst most young people are law-abiding and cause no problems, the presence of certain groups of teenagers can often discourage genuine customers from entering shops and other premises with a subsequent detrimental effect on turnover and profits. This type of anti-social behaviour has become the biggest threat to private property over the last decade and there has been no effective solution until now. The Mosquito ultrasonic deterrent provides the first practical solution to the eternal problem of unwanted gatherings of youths and teenagers in shopping malls and other retail areas.

The Mosquito generates a high frequency sound that is audible only to teenagers. It is completely harmless even with long-term use and rarely affects older people as it relies on a medical phenomenon known as presbycusis, or age related hearing loss. This begins after the age of 20 but is usually significant only in persons over 65. It first affects the highest frequencies (18 to 20 kHz), which is where Mosquito operates.

With an effective range of between fifteen and twenty meters, field trials have shown that teenagers are acutely aware of the Mosquito and usually move away from the area within just a couple of minutes.

The ultrasound produced has no effects on pets or other animals and can safely be used in all public areas, business or domestic premises.

Mosquito has generated unprecedented press interest around the World, being featured on prime-time television in over 50 countries, and is set to become one of the British Security Industry's biggest success stories.

Two different Mosquito models will be produced at the Cwmbran, South Wales, factory of Fulleon Limited, Cooper Menvier's market-leading alarm signaling division. These will be marketed as:

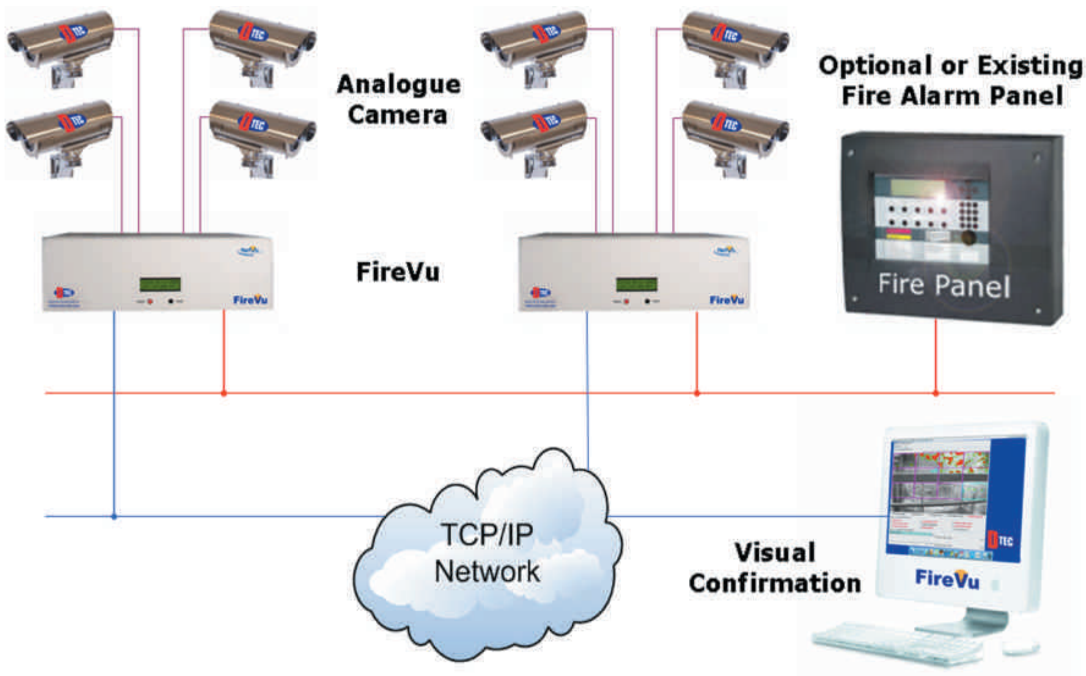
Mosquito from Fulleon – which will be available through Fulleon's normal electrical and fire distribution channels;

Mosquito from Cooper Security – which will form part of Cooper Security's portfolio of advanced-technology security products.

For further information contact:
Robert Campbell
Sales Director
Fulleon Limited
Tel: +44 (0)1633 628500

Video Smoke Detection – A proven alternative

The D-Tec Video Smoke detection system (VSD) continues to lead the camera based fire detection market by continually improving and addressing the demands of client's applications around the world.



VSD is based on sophisticated computer analysis of the video image seen by the CCTV camera (optical sensor). Using advanced image-processing technology and extensive detection algorithms, VSD can automatically identify the distinct characteristics of smoke patterns. The VSD system uses standard CCTV equipment linked to a proprietary processing unit which is capable of recognising small amounts of smoke within the video image. Fire events are detected at source in any voluminous environment. The end user is alerted of events by fully configurable relay contacts which then activate the fire system the video image is simultaneously sent to the end user coupled with the real-time smoke overlay providing high impact visual verification of fire events. All alarm conditions are logged, time/date stamped and stored within the system's memory. A VSD system can be tailored for any size installation in the most diverse environments.

Late in 2005, D-Tec launched its new camera-based video smoke detection system, FireVu. The concept moves video smoke detection into a new era. Now offering Flame detection to complement the early warning smoke detection provides enhanced capability to provide AND/OR functionality with regards to event activation. All events are distributed over IP to provide additional features such as remote monitoring. This distributed visual confirmation complements the hard wired outputs.

Since its release the number of installations around the world has continued to grow. Fire safety professionals from around the world are now turning to D-Tec for its solution to problematic areas such as Atria, Tunnels, Hangars, Warehouses, Chemical Plants, Recycling Plants and Power Generation Turbine Halls. We have recently commissioned systems in the Sydney Harbour Tunnel, Royal Ascot Racecourse, Swiss-Re building in London, Airbus A380 Royal Airwing Hangar at the Dubai International Airport and FMC Lithium Chemicals (UK). With such prominent global installations D-Tec's reputation is firmly established.

Within the last year D-Tec has appointed reputable companies in Portugal, Slovenia and Belgium in order to introduce VSD to the European market and make it a solution to problematic areas such as Forests, Aviation, Power Generation Plants and Road Tunnels. IFP

For a full reference list visit the D-Tec website at www.dtec-fire.com

FYREWRAP®

A World Of Fire Protection Solutions

Introducing FyreWrap® fire protection materials now available worldwide.

Wherever high heat or potential fire is a problem, FyreWrap fire protection materials offer a world of solutions for passive fire protection applications. FyreWrap materials are lightweight, easy to fabricate and capable of providing protection up to 2300°F. A complete line of product forms are available for applications including:

- Marine bulkhead and deck insulation
- Through penetration firestops
- Construction joints
- Fire doors and seals
- Electrical circuit protection systems
- Grease and HVAC ducts

Backed by more than 50 years of Unifrax expertise and an experienced worldwide staff, the FyreWrap product family provides proven systems to meet international and local fire standards and code requirements in the commercial building, transportation and manufacturing industries.

For more information, contact Unifrax Corporation, Corporate Headquarters USA 716-278-3800.

UNIFRAX

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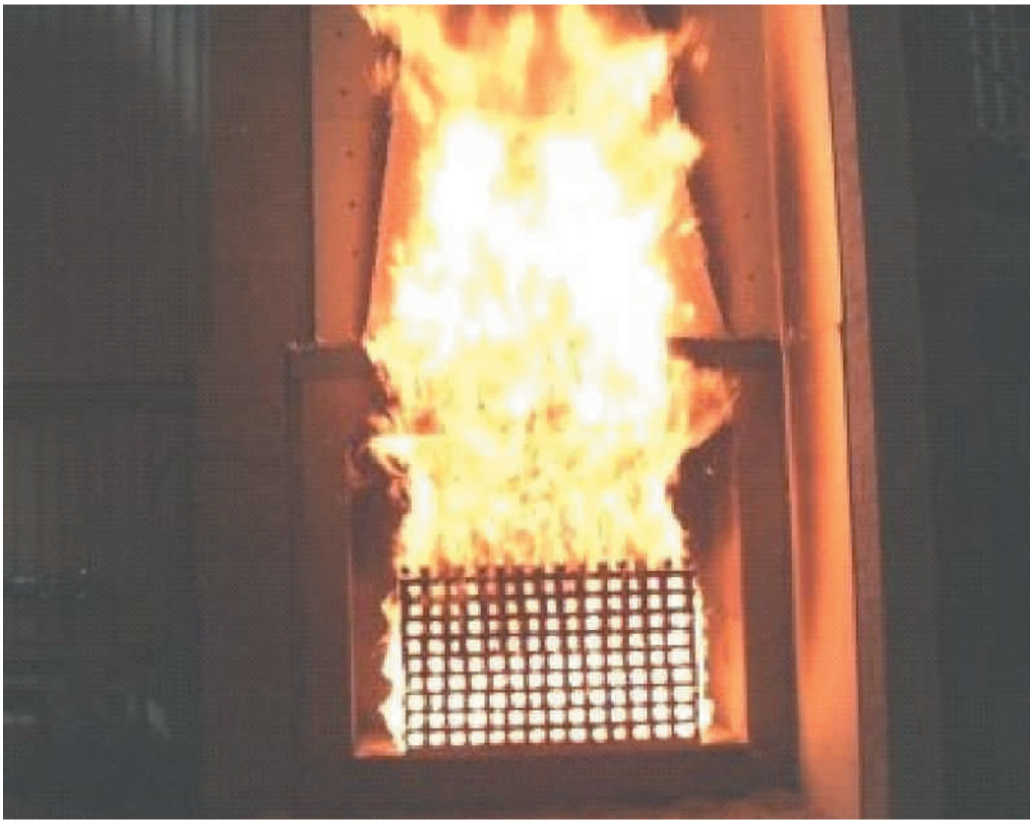
System under test on BRE External Cladding Test Facility



Assessing the fire performance of external cladding systems

By Sarah Colwell

BRE

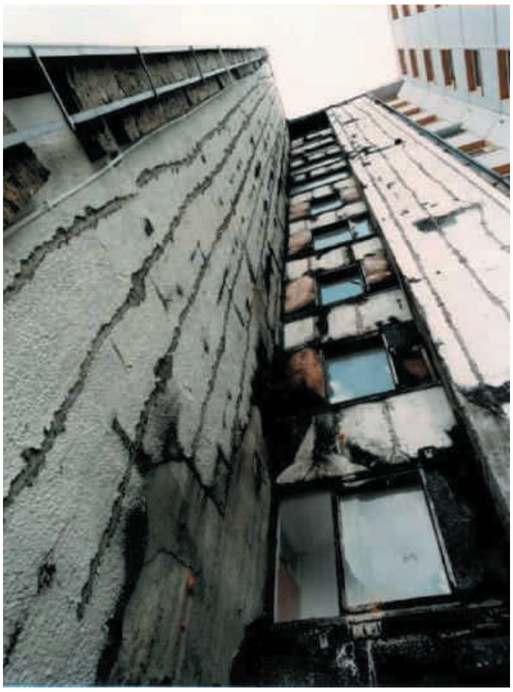
The Issue

Fires involving multi-storey buildings are fortunately rare but when they occur, they have the potential to be dangerous, both in terms of risk to life and property loss. They can generate major disruption to commercial business or domestic life if dwellings are involved.

Losses from commercial property can be considerable. The Basingstoke fire in 1991, in which two floors of a 14-storey office block were damaged, resulted in a £15.6M claim and the more recent fire in Madrid, in 2005, led to significant property and consequential losses.

It was estimated in 2001 that there were over 5,000 blocks of flats in England, representing about 300,000 homes. One the fire issues raised with this type of building is the potential for fire to spread via the external cladding on the structure, as seen in the Knowsley Heights fire in 1991.

The Garnock Court fire in Irvine, Scotland in 1999, gave rise to a Parliamentary inquiry into the potential risk of fire spread in buildings via external cladding. One of the recommendations from the inquiry included the statement that "we do not believe it should take a serious fire in which people are killed before all reasonable steps are taken towards minimising the risks." As a consequence of this, BRE's sister company the Loss Prevention Certification Board (LPCB) constantly develop and publish certification schemes that protect people and their property. Some examples can be found at the end of this article. For a full listing visit: www.redboolive.com

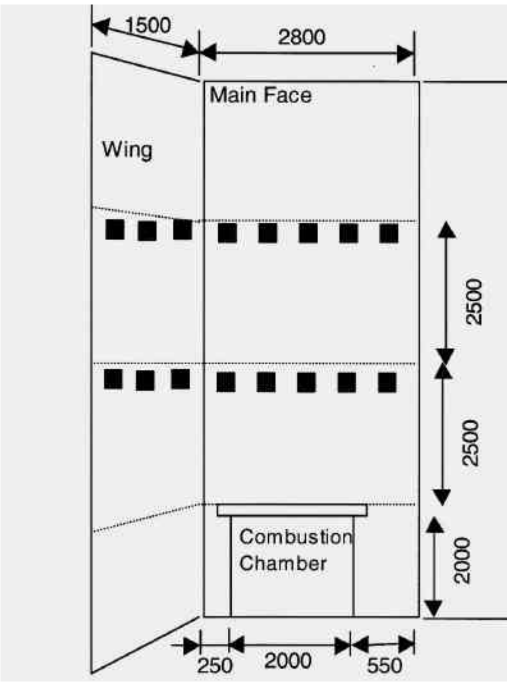


Knowsley Heights

External Fire Spread

Fires can occur within a property or in close proximity to the building envelope. If no intervention occurs, the fire within the building may develop to flashover and break out from the room of origin via a window opening or doorway. Flames breaking out of a building from a post flashover fire will typically extend 2m above the top of the opening irrespective of the material used to construct the outer face of the building envelope and the potential then exists for any external cladding system to become involved in the fire.

BS 8414: Part 1: 2002 – Fire performance of external cladding systems. Part 1. Test method for non-loadbearing external cladding systems applied to the face the building.



Test facility

BS 8414 : Part 1: 2002, based on BRE Fire Note 9, is a full-scale test designed to investigate the fire performance of non-loadbearing exterior wall systems, including external wall insulation systems and curtain walling, fitted to a masonry substrate when exposed to an external fire source at a realistic scale.

A 9.6m high test facility is used with a main face 2.8m wide and includes a right angle internal return wall, a minimum of 1.5m deep. The fire source is designed to represent a post flashover fire exiting from an opening such as a window in a post flashover room. The duration of the fire source is 30 minutes.

Thermocouples are placed at the mid-depth of each combustible layer and cavity where present. The thermocouples are located at two heights above the fire source; 2.5m and 5m and the time taken for the fire to spread between these two levels is determined for each layer and cavity in the system. Any system collapse or delamination is also noted. The test method does not assess the fire resistance of the exterior wall assembly.

BR135 – Fire Performance of External Thermal Insulation for Walls of Multi-Storey Buildings. Second Edition.

The second edition of the BRE Report 'BR135 – Performance of External Thermal Insulation for Walls of Multi-Storey Buildings' was published in 2003. This document provides updated guidance on the fire performance of external cladding systems and a classification system for the BS 8414 – 1:2002 test method. The principles behind the classification system are based on fire spread away from the initial fire source and the rate of fire spread. Additionally if fire spreads away from the initial fire source, the rate of progress of fire spread, or tendency for collapse, should not unduly hinder intervention by the emergency services.

BS8414: Part 2:2005 – Fire performance of external cladding systems. Part 2. Test method for non-loadbearing external cladding systems applied to a steel frame.

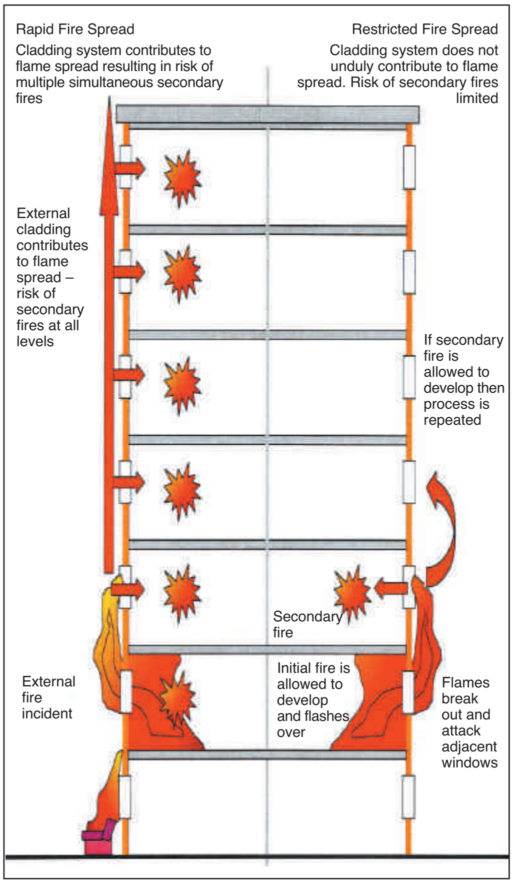
The increasing use of lightweight framed systems and offsite construction techniques for these types of buildings identified a need to provide a second part of the test standard to allow these types of systems to be assessed. This part of the standard can be used for assessing the fire performance of non-loadbearing external cladding systems supported by a building frame, such as curtain walling, glazed units, infill panels and insulated composite panels at full-scale. The specimen sizes, fire exposure conditions and monitoring locations are the same as those used in Part 1 of the BS 8414-1:2002.

As with part 1 of the test method, a classification system for this part of the test standard is currently being drafted as an annex to the BR135 document.

Guidance for current Building Regulations in England and Wales

Where the guidance provided in Approved Document B (AD B) (Fire Safety) to the Building Regulations 2000 cannot be met for the fire performance of external cladding system, an alternative method such as BRE Fire Note 9 can be used to demonstrate that the risks of spread of

Principle behind BS 8414 parts 1&2 and BR 135



fire over external walls have been minimised. This test method does not assess the fire resistance of the systems nor does it address the provisions for fire spread between buildings. BR135 Second Edition, BS 8414-1:2002 and BS 8414-2:2005 have superseded BRE Fire Note 9.

Technical Approval

As part of the Construction Products Directive (CPD), an ETAG (European Technical Approval Guideline has been produced by EOTA to enable CE marking of these types of products), ETAG 004 for External Thermal Insulation Composite Systems with Rendering was published in 2000 to provide a route for CE marking of these products. As part of this ETAG, the reference to fire performance includes the provision for the use of full-scale testing to evaluate the performance of fire barriers for insulated systems, if required.

Certification

One method of ensuring that the product meets a standard is to choose one that is approved by a nationally accredited certification body, such as the Loss Prevention Certification Board (LPCB). Certification by LPCB is independent third party confirmation that the product meets and continues to meet the appropriate standard. The certification process involves rigorous assessment and testing of products coupled with regular audits of quality procedures governing the factory production process to ensure that they meet quality standards reviewed by a team of experts which include manufacturers, installers, designers, clients, regulators, insurers, engineers and scientists. This differs from a test which is basically a snapshot showing that the product passed the test on a given day, whereas certification, through regular audits, ensures that the product continues to comply with the standard and meet the specification.

In order to meet the demands from the market for certification schemes to cover the fire performance of composite systems, a new LPCB scheme has been launched as part of the LPS 1181 series of fire growth tests for LPCB approval of construction product systems. LPS1181 part 4 covers systems tested under BS8414-1:2002 with a part 5 scheme in preparation to cover BS 8414-2:2005 systems.

There are many approval bodies including some with their own strong brands. However, not all of them have their own on-site testing facilities and expertise. LPCB, together with its predecessor the Fire Offices' Committee (FOC) has been involved for over 150 years in working with specifiers including clients, insurers, and regulators to set the standards necessary to ensure the quality of products in the market place.

Listing

Once a product, service or company meets the required standard, a certificate is issued and listed in the relevant 'Red Book', either under the List of Approved Fire and Security Products and Services or List of Approved Companies and Construction Products. Listing in the Red Book is a very useful marketing tool for the approved companies as thousands of specifiers and insurers around the world use the Red Book to select their suppliers. The Red Book is published in January each year and on CD ROM in January and June of each year. A "live" copy of the Red Book is continually updated online at www.RedBookLive.com.

A small list of LPCB certification schemes:

- LPS 1107-1.1 Requirements, Tests and Methods of Assessment of Passive Fire Protection Systems for Structural Steelwork
- LPS 1132-4.1 Requirements and Tests for LPCB Approval of Wall and Floor Penetration and Linear Gap Seals
- LPS 1158-2.1 Requirements and Tests for Fire Resistant Glazing Systems
- LPS 1208-2.1 LPCB Fire Resistance Requirements for Elements of Construction Used to Provide Compartmentation
- LPS 1181 Part 1-1.1 Requirements and Tests for Built-up Cladding and Sandwich Panel Systems for Use as the External Envelope of Buildings.
- LPS 1181: Part 2 – Issue 2.0 Requirements and Tests for sandwich panels and built-up systems for use as internal constructions in buildings
- LPS 1181: Part 4 – Issue 1 Requirements and Tests for External Thermal Insulated Cladding Systems with rendered finishes (ETICS) or Rain Screen Cladding systems (RSC) applied to the face of a building.
- LPS 1196-1.1 Requirements and Tests for Exposed Surfaces Having Reaction to Fire Classifications of Class 0 and Class 1
- LPS 1204-2.1 Requirements for Firms Engaged in the Design, Installation and Commissioning of Fire Fighting Systems
- LPS 1260-2.2 Requirements for Testing Plastic Pipes and Fittings for Sprinkler Systems
- LPS 1261-1.1 Requirements for Testing Flexible Hoses for Sprinkler Systems IFP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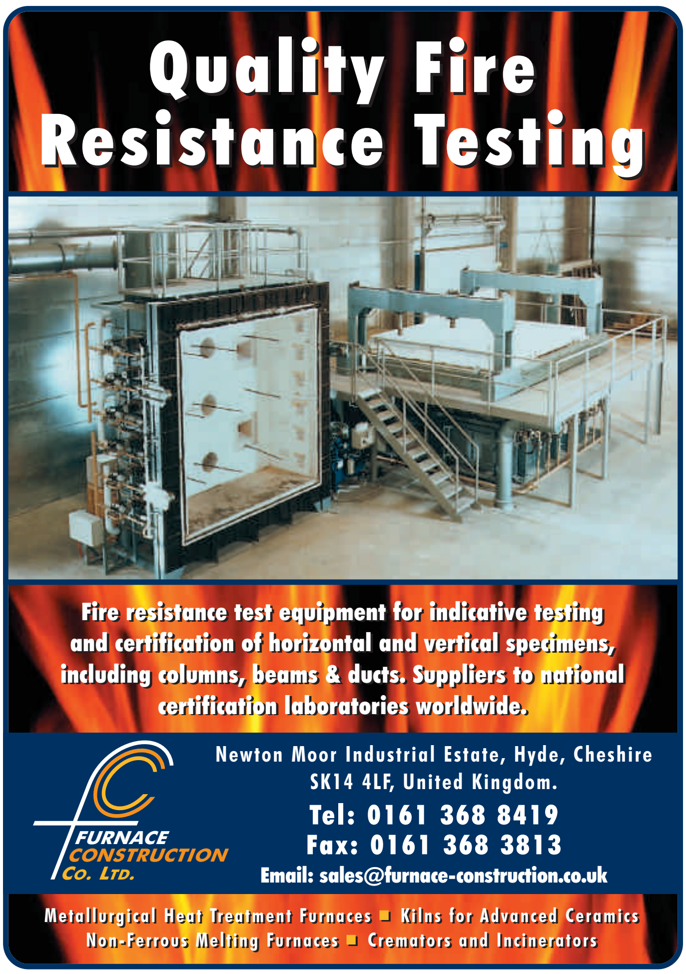
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Clean suppression agents come of age

By Andrew Shiner

Director of Marketing, Europe, Middle East & Africa
Tyco Fire and Security's Fire Suppression Group

The banning of Halon 1301 gave the fire industry the much-needed boost to develop clean suppression agents. Here, Andrew Shiner, Director of Marketing, Europe, Middle East and Africa for Tyco Fire and Security's Fire Suppression Group, looks at the new systems that tick the environmentalists' boxes.

Long before the politicians put pen to paper in the late 1980s to seal the fate of Halon 1301 with the signing of the Montreal Protocol on Substances that Deplete the Ozone Layer, fire safety companies around the world had already devoted thousands of man-hours in the quest for an alternative. High on their agendas was that the solutions should be acceptable to the increasingly powerful environmental lobby, and that they had to be long-term solutions – "sustainability" was, and still is, a key word.

The fact that global warming results in climate change is now widely accepted. So much so, that the Kyoto Protocol – or to give it its formal title: the Kyoto Protocol to the United Nations Framework Convention on Climate Change – has, as its goal, the reduction of greenhouse gas emissions, of which Carbon Dioxide makes up 84 percent. Rainfall patterns are changing, as can be seen by the increased flooding in many parts of the world; sea levels are rising; glaciers are retreating; polar sea-ice is thinning; and the incidence of extreme weather is increasing in some parts of the world.

If this trend continues, scientists predict that it is inevitable that there will be permanent flooding of many low-lying regions. Heat waves have already proved fatal to the old and infirm, and there are real concerns that heavy rainfall can increase the incidence of water-borne diseases such as typhoid, cholera and malaria. Water-borne diseases already fill half of the world's hospital beds. At the same time, two-fifths of the world's population already face serious water shortages.

Sadly, some of the first attempts to find clean alternatives failed to live up to expectations. Many Halocarbons – Halon-like compounds – generically known as HFCs – failed due either to their inefficiency as a firefighting agent, or their toxicity. The more successful and acceptable were broadly embraced, and it is beyond dispute that their availability on the market certainly assisted the Halon phase out programme, and powered the transition

away from ozone depleting substances. The important point, however, is that these agents were not without an environmental downside. Without exception, all had significant global warming potential.

Inert gas systems

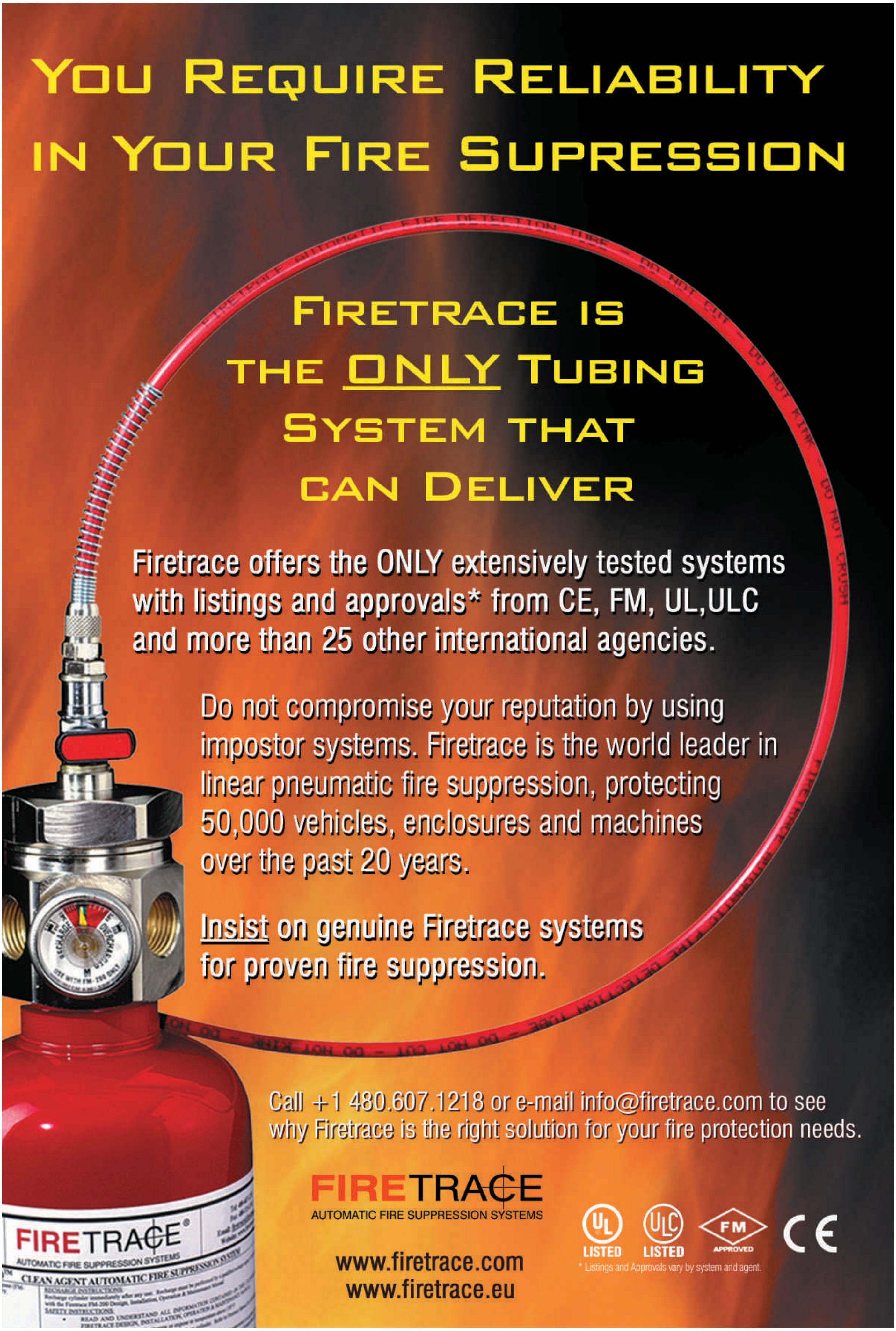
One answer to the global warming challenge was the wider adoption of inert gases. They have precisely the environmental credentials that the market seeks: zero ozone depletion potential, zero atmospheric lifetime and zero global warming potential. Inert gases are non-toxic, they will not harm sensitive electronic equipment, art treasures or documents, and are safe to use in enclosed areas where people may be working.

These gases are a non-conductive and non-corrosive blend of naturally occurring gases – such as a combination of Nitrogen, Argon and Carbon Dioxide – or, less frequently, a single naturally occurring gas. Inert gas suppression systems, such as Tyco's Inergen inert gas system, which is available under the Ansul brand, and Tyco's new Hygood i3 system, work by lowering the oxygen content of the protected area to a point that will not support combustion, but is sufficient to sustain human life. This is not unlike the way in which Carbon Dioxide systems work. Unfortunately though, when used at design concentration, Carbon Dioxide is lethal to room or enclosure occupants, which additionally limits its applications.

However, certain factors focused the industry's attention on finding a chemical solution. These included the demand for more space to store the inert gas suppressant's cylinders and, a requirement for more onerous venting. To illustrate this point, an inert gas installation typically takes up to seven times the space of a comparable Halon 1301 installation, which is a serious consideration where, in London's West End for example, office space costs in the order of US$1,300 a square metre a years. This is not to say that inert gases do not have their attractions, particularly to organisations where specifying a non-chemical suppressant is of overriding importance, or where storage space is not a determining factor.

Sustainable chemical suppressant

The latest solution meets all of the market's requirements and is the result of more than four years concentrated effort and testing. It is a high performance fire-extinguishing agent that has a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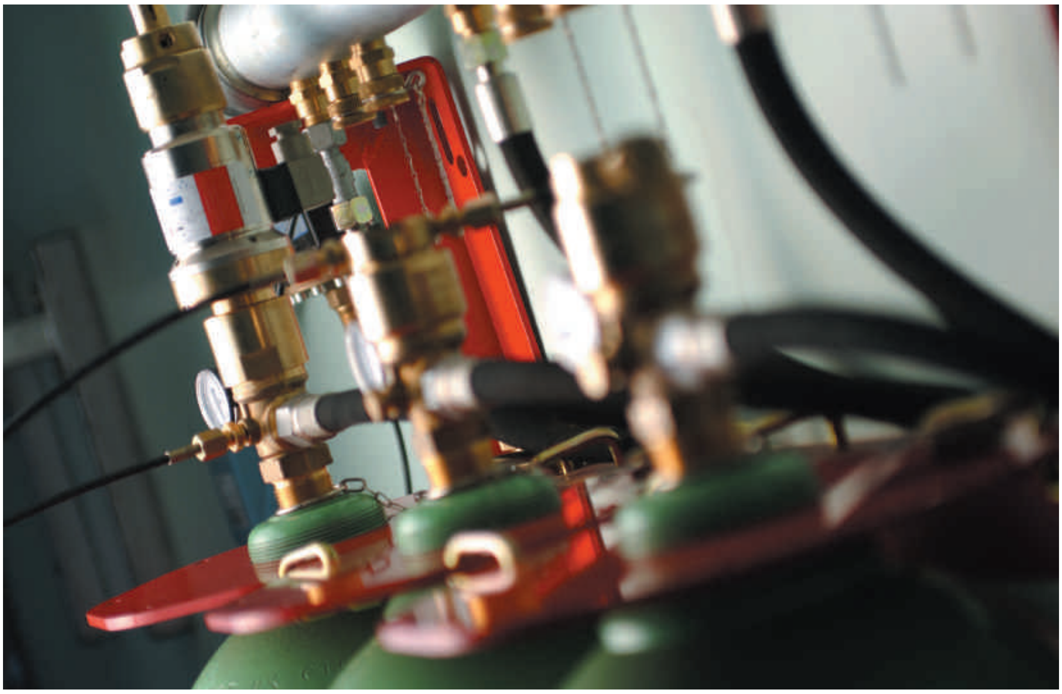
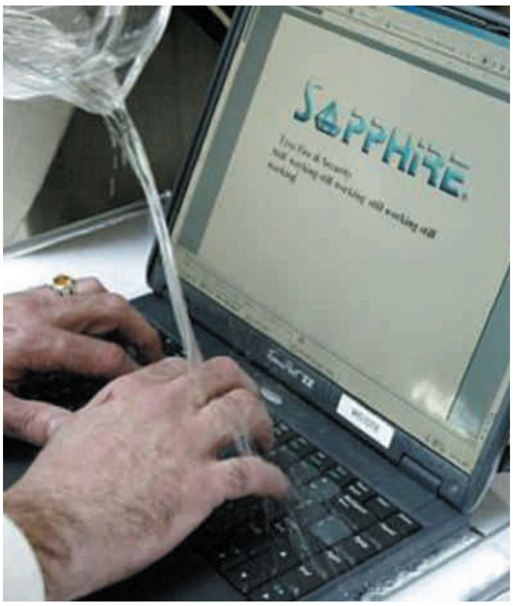


negligible impact on the environment and is designed primarily to protect essential and delicate telecommunications and data processing equipment, plus it has applications within the cultural heritage sector protecting artefacts that would otherwise be destroyed by water from traditional sprinkler systems. This solution has an insignificant global warming potential, lower than any of the halocarbon agents acceptable for use in occupied spaces. In a word, the solution is sustainable.

It is a fluid-based suppression system, called Sapphire, that uses 3M Novec 1230 Fire Protection Fluid, a sustainable, long-term technology that not only satisfies today's regulations, it also meets all of those in the foreseeable future. It utilises new technology and has several advantages over other Halon alternatives, or extinguishants currently on the market with unacceptably high global warming potential. International certification of the new fluid-based system includes LPCB approval, FM approval and UL listing.

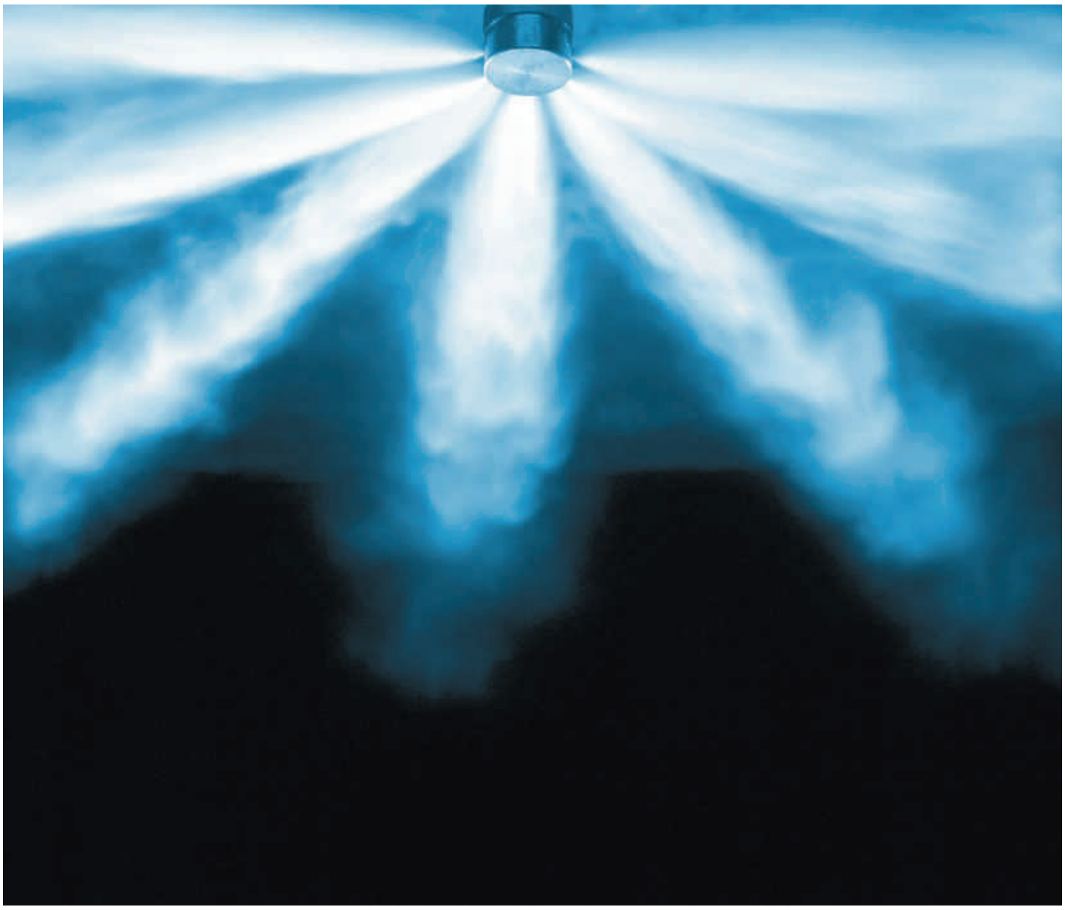


The Novec 1230 fluid is not an HFC; it is a fluorinated ketone with a chemical structure of $CF_3CF_2C(O)CF(CF_3)_2$. This molecule was chosen, after careful consideration, because it provides an ideal combination of fire extinguishing performance, toxicological and environmental properties.

Installations of the new system have a footprint similar to that of chemically-based systems, the lowest level of design concentration, and the highest safety margin of any viable Halon 1301 or chemical alternative. The suppressant also has impressive "environmental footprint" credentials with zero ozone depleting potential and a remarkably low atmospheric lifetime of just five days. This compares with an atmospheric life for Halon 1301 of an astounding 107 years. Most significantly, it is not included in the basket of greenhouse gases identified by the Kyoto Protocol.

To put this into perspective, the Novec 1230 fluid has a global warming potential of just "one". Compare this with a not untypical HFC – HFC 125 – that, incidentally has a atmospheric lifetime of 33 years, against the new fluid's five days. For the release of just one kilogramme of HFC 125, a staggering 2,800 kilograms or 2.8 tonnes of the Novec 1230 fluid would have to be released to have the same impact on climate change.

The Novec 1230 fluid is stored in cylinders as a low vapour pressure fluid that transmutes into a colourless and odourless gas when discharged. Unlike most fluid fire extinguishing agents, it can be used with absolute confidence to suppress fires involving electronic, computing or communications equipment. This has frequently been graphically demonstrated by immersing a laptop computer into a tank of the fluid and showing that, not only does the laptop still work after the dunking, it works while it is still immersed in the tank. Similarly, the suppressant's suitability for protecting archives and museums has been established in similar witnessed trials that prove that a document can be immersed in the Novec 1230



fluid without damaging it, or even causing the ink to run!

Typical total flooding applications use between just four and six percent by volume of the fluid, which is well below the agent's saturation or condensation level. When discharged, the agent is dispersed through natural ventilation, leaving no residue to damage sensitive electronic equipment; it is also non-conductive and non-corrosive.

One of the significant attractions of Halon 1301 was that it was seen to be safe for humans at normal use concentrations, which led to its acceptance for use in occupied spaces. However comparing the gases' NOAEL or No Observed Adverse Effect Level with its normal design concentration of five percent clearly shows that Halon, in reality, had no safety margin. While certain HFCs and inert gases are used at design concentrations that are below the NOAEL, with safety margins that range from seven percent to 20 percent, no other Halon alternative comes anywhere close to the Novec 1230 fluid's 92 percent safety margin.

Of particular importance to the system installer is the fact that Novec 1230 fluid can be transported safely – even by air – in bulk quantities without any onerous restrictions and, because it is a non-pressurized fluid, refilling a system after discharge is simpler and faster than with many gaseous agents.

Water mist option

While the majority of the industry's attention has gone on finding a chemical solution, work has also progressed on the development of water-based systems. So much so that water mist systems have been introduced that are appropriate for a number of applications. Systems, such as Tyco's new High Pressure Water Mist (HPWM) system, are extremely popular from an environmental standpoint, as they contain nothing but pure, potable water and so are completely safe for people and totally harmless to the environment.

The Tyco HPWM system is water that, at a pressure of 100bar, converts on discharge to a fine atomised mist. This fine mist evaporates very quickly and is converted into steam that smothers the fire and prevents further oxygen from reaching it. At the same time, the evaporation of the water creates a significant cooling effect. So the fire is extinguished by oxygen depletion and cooling. This combines the fire suppression characteristics of both conventional water-based suppression systems – deluge or sprinkler systems – and gaseous fire suppression systems.

Another environmental plus in its favour is that, when compared with conventional water sprinkler systems, the HPWM system uses only ten percent of water for a given area. This also has the benefit of minimising the potential for water damage on discharge or in the unlikely event of an unwanted system release. Smaller pipework dimensions result in a considerable reduction in weight, and enable the system to be installed in confined spaces.

While water mist systems have been used for some time in industrial and certain types of commercial premises, the scope for using them in offices and archives, for paint spray booth and industrial deep fat fryer protection, maritime storage and accommodation areas, engine room and even wind turbine protection is only now being realised. IFP

Further details are available by telephone on +44 (0) 1493 41760, by fax on +44 (0) 1493 417700, or via email at ashiner@tycoint.com

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New Fire Safety Rules Coming into Force on 1 October 2006

The Regulatory Reform (Fire Safety) Order 2005 (RRO 2005), originally intended to be brought into force on 1 April 2006, is coming into force on 1 October 2006 and anyone who is classed as a "responsible person" under RRO 2005 needs to be aware of the changes in relation to fire safety on premises and make provision for them.

By Anna Rabin

Head of Construction
Jeffrey Green Russell

What does RRO 2005 cover?

RRO 2005 will repeal or amend of over 70 pieces of legislation, including the Fire Precautions Act 1971 and Fire Precautions (Workplace) Regulations 1997.

The following changes to the current fire safety laws are of particular note:

- Fire certificates will no longer be valid when RRO comes into force.
- The focus of RRO 2005 is on risk assessment. This builds on the approach to fire safety established by the Fire Precautions (Workplace) Regulations 1997 under which an employer is required to comply with the regulations in respect of any workplace under the employer's control.
- Compliance with RRO 2005 is the duty of the "responsible person".
- Employees are subject to general duties under RRO 2005, including a duty to co-operate and to alert the employer to certain risks.
- In multi-occupied buildings, the owners and occupiers of other parts of the building are required to co-operate with the responsible person in making arrangements for maintenance of facilities, equipment and devices for fire safety.
- Duties in respect of fire safety are owed not only to employees but also to "relevant persons", which include anyone lawfully on the premises or in the vicinity of the premises and at risk from fire at the premises.
- If premises are subject to separate licensing control (for example, theatres and sports grounds), fire safety requirements specified in the licence must be consistent with those contained in RRO 2005.
- The Department for Communities and Local Government (DCLG) (which replaces the Office of the Deputy Prime Minister as from 5 May 2006) is required, under RRO 2005, to issue guidance to assist "responsible persons" in the carrying out of their duties under RRO 2005.
- Enforcement of the provisions of RRO 2005 remains the responsibility of the local fire authority for most types of premises. Sanctions for failure to comply with RRO 2005 include fines and imprisonment.

Who is a "responsible person"?

A "responsible person" is defined in Article 3 of RRO 2005 as:

(a) in relation to a workplace, the employer, if the workplace is to any extent under his control;

(b) in relation to any premises not falling within paragraph (a):

Duties in respect of fire safety are owed not only to employees but also to "relevant persons", which include anyone lawfully on the premises or in the vicinity of the premises and at risk from fire at the premises.

(i) the person who has control of the premises (as occupier or otherwise) in connection with the carrying on by him of a trade, business or other undertaking (for profit or not); or

(ii) the owner, where the person in control of the premises does not have control in connection with the carrying on by that person of a trade, business or other undertaking.

A person with obligations under a lease or any other contractual agreement for maintenance or safety of the premises is considered to have control of the premises. Otherwise, the obligation falls on the owner, for example, in the case of a newly constructed building which has yet to be occupied.

What must the "responsible person" do?

Article 8 of RRO 2005 sets out the general duties of the responsible person.

The responsible person must:

(a) take such general fire precautions as will ensure, so far as is reasonably practicable, the safety of any of his employees; and

(b) in relation to relevant persons who are not his employees, take such general fire precautions as may reasonably be required in the circumstances of the case to ensure that the premises are safe.

Essentially, "general fire precautions" in relation to premises means:

(a) measures to reduce the risk of fire on the premises and the risk of the spread of fire on the premises;

(b) measures in relation to the means of escape from the premises;

(c) measures for securing that, at all material times, the means of escape can be safely and effectively used;

(d) measures in relation to the means for fighting fires on the premises;

(e) measures in relation to the means for detecting fire on the premises and giving warning in case of fire on the premises; and

Identification of general fire precautions is made as a result of the responsible person carrying out risk assessments, which must be regularly reviewed to ensure they are up-to-date.

(f) measures in relation to the arrangements for action to be taken in the event of fire on the premises, including:

   (i) measures relating to the instruction and training of employees; and

   (ii) measures to mitigate the effects of the fire.

Identification of general fire precautions is made as a result of the responsible person carrying out risk assessments, which must be regularly reviewed to ensure they are up-to-date. There are provisions which need to be adhered to in relation to any "dangerous substance" (for example a substance which is explosive or flammable) that is or is liable to be present in or on the premises.

Guidance

The Department for Communities and Local Government has published a number of guides relating to the different types of premises that are covered by the RRO 2005. These guides may be downloaded free of charge by logging on to

The Department for Communities and Local Government has published a number of guides relating to the different types of premises that are covered by the RRO 2005.

www.odpm.gov.uk and going on to the pages of the website dealing with Fire Safety Law. The guides are summarised below and are designed so that a responsible person, with limited formal training or experience, should be able to carry out a fire risk assessment.

- **Fire Safety Risk Assessment – Offices and Shops**
  This guide is applicable to buildings where the main use of the building, or part of the building, is an office or shop including:
  - purpose built or converted office blocks; and
  - individual office or shop units which are part of other complexes.

Those responsible for the overall management of multi-use shopping areas should refer to the **Large Places of Assembly guide**.

- **Fire Safety Risk Assessment – Factories and warehouses**
  This guide is for use in connection with premises where the main use of the building, or part of the building, is a factory or warehouse including:
  - large and small factories;
  - manufacturing warehouses;

- storage warehouses; and
- factories with warehouses.

■ **Fire Safety Risk Assessment – Sleeping accommodation**
Most domestic premises are excluded from the requirements of the RRO 2005. However, the legislation has limited application to sleeping accommodation, including:
- common areas of houses in multiple occupation, flats and maisonettes and sheltered accommodation where care is not provided;

Hospitals, residential care and nursing homes and prisons and other establishments where people are in lawful custody are excluded from the scope of this guide.

- holiday chalets, holiday flat complexes, camping, caravan and holiday parks (other than privately owned individual units);
- areas in work places where staff "sleeping in" is a condition of the employment or a business requirement as in licensed premises or hotels.

Hospitals, residential care and nursing homes and prisons and other establishments where people are in lawful custody are excluded from the scope of this guide.

■ **Fire Safety Risk Assessment – Educational premises**
This guidance relates to:
- schools including Sunday schools and after school clubs;
- universities;
- academies;
- crèches;
- adult education centres;
- outdoor education centres; and
- music schools.

■ **Fire Safety Risk Assessment – Small and medium places of assembly**
For the purposes of this guidance "small" means premises accommodating up to 60 people and "medium" means premises accommodating up to 300 people. This guidance is relevant to the following types of premises:
- public houses;
- clubs;
- village halls and community centres;
- churches and other religious centres; and
- marquees and tents.

Sports grounds and common areas of shopping malls are covered by separate guidance.

■ **Fire Safety Risk Assessment – Large places of assembly**
This guidance is applicable to the following

types of premises, if more than 300 people could gather there:

- sports stadia;
- exhibition and conference centres;
- large nightclubs;
- churches, cathedrals, other places of worship;
- community centres and village halls;
- common areas of shopping malls; and
- premises that adjoin other complexes such as shopping centres.

- **Fire Safety Risk Assessment – Theatres and cinemas**
  This guidance is designed for premises where the main use of the building, or part of the building, is a theatre, cinema or multi-screen cinema. Concert halls are also covered by this guidance.

This guidance is designed for premises where the main use of the building, or part of the building, is a theatre, cinema or multi-screen cinema.

There are four further specific guides which are currently being developed by DCLG and will be published in due course.

- **Fire Safety Risk Assessment – Residential care premises**
  This guide will be for premises where the main use of the building, or part of the building, is to provide residential care. It will be intended for non-domestic residential premises with staff in

This guide will be for premises where the main use of the building, or part of the building, is to provide residential care.

attendance at all times and where many, most or all of the residents would require carer assistance to be safe in the event of a fire i.e. where residents would not be able to make their way to a place of safety unaided. These could include:

- residential and nursing homes;
- rehabilitation premises providing residential treatment and care for addiction; and
- care homes and care homes with nursing (as defined by the Care Standards Act).

The guide will **not** be for day-care centres with no residential clients, sheltered accommodation where no care is provided, hospitals or out-posted nursing care in single private dwellings.

- **Fire Safety Risk Assessment – Outdoor Events**
  This guide will cover premises holding outdoor events and venues will include:

- zoos;
- music concerts;
- sporting events;
- firework displays; and
- markets.

- **Fire Safety Risk Assessment – Healthcare Premises**
  This guide will be for premises where the main use of the building, or part of the building, is to provide healthcare including:

- hospitals;
- medical centres; and
- other healthcare premises.

This guide will be for premises where the main use of the building, or part of the building, is to provide healthcare.

This guide will **not** be intended for use in care and nursing homes, rehabilitation premises, day-care centres with no residential clients, sheltered accommodation, out-posted nursing care in single private dwellings and staff accommodation.

- **Fire Safety Risk Assessment – Transport premises and facilities**
  This guide will cover transport premises and facilities including:

- train, bus, coach and airport transportation terminals and exchanges;
- rail and road tunnels;
- passenger ferry ports and facilities;
- taxi stands and facilities; and
- shipping ports and terminals.

This guide will cover transport premises and facilities.

This guide will **not** apply to the offices and shops within transport premises and facilities.

A basic guide **(Entry Level Guide – A short guide to making your premises safe from fire)** is also available that provides simple and practical advice to people responsible for fire safety in small and medium businesses. IFP

For further information, please contact:
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It is very dangerous when the fire gets out of control in a wind turbine, after a while burning parts will start falling to the ground

© Danfoss Semco

The wind of change

Wind generated power is the fastest growing energy source in the world. This is not surprising when you consider that a single wind turbine is capable of generating up to 1.5 megawatts. As a result, wind farms are already found across America and in every country in Europe yet the industry is growing by 20-30% annually. And as the popularity of this technology continues to grow, so must the focus on effective means of protecting wind turbines and their surrounding environment from the risk of fire.

By Palle Madsbjeg

Sales Manager
Danfoss Semco

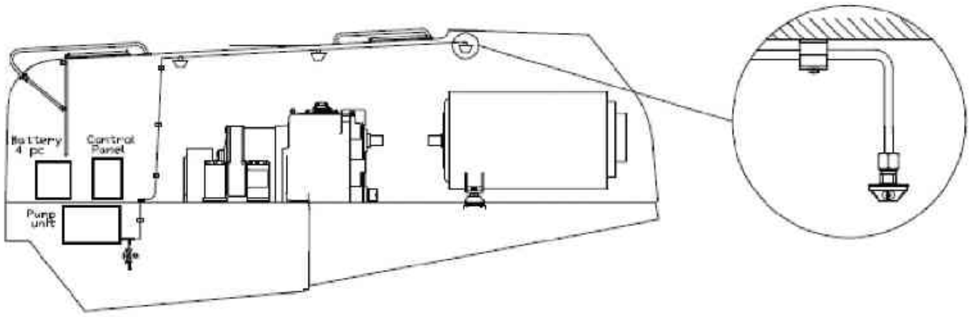
Total loss

When a fire starts in a wind turbine, the destruction can be complete. Many existing fire prevention systems merely detect fire and raise the alarm, but as a turbine can be up to 100 metres tall, with rotor blades longer in diameter than the wingspan of a jumbo jet, there is very little the fire brigade can do to reach and tackle the blaze once summoned. Therefore, the damage has to be considered as a total loss, from an insurance point of view. But the loss of the turbine is not the only risk. Without adequate protection in place, it can be very difficult to evacuate technicians working in the turbine's nacelle, particularly when the turbine is off-shore, while due again to this sheer height, and the size of the rotors, burning debris falling to the ground or caught on the wind can result in serious unforeseen structural and fire damage in the surrounding area.

Understanding

As a country that generates 20% of its electricity with wind power, Denmark has for many years boasted some of the industry's market leaders in the production of wind turbines. As a result, many Danish sub-suppliers have become experts within, and brought innovation to, numerous areas around wind turbine performance, design and safety. One such company is Danfoss Semco A/S, a specialist in developing and supplying fire-fighting systems for use on land and at sea.

Side view of a nacelle of a wind turbine, with high pressure water mist extinguishing system installed



The problem

A wind turbine's profitability is determined by its size. Winds are stronger at higher altitudes so the taller a turbine's blades stand, the more efficient and cost effective its performance. And as the size and use of wind turbines have grown, so has the work within and around the industry to identify and eliminate areas of vulnerability. The structure of both turbines and their towers has been addressed to reduce vibrations and structural weaknesses. And because they are so difficult to access much has already been done to protect against fire caused by exploding transformers, lightning or overheated brakes. However, the large amount of oil used in a wind turbine, from the hydraulic system to the oil-cooled transformers and oil-lubricated gearboxes continues to present a huge fire risk, one that has the potential to spread throughout the whole construction and cause damage further a field.

The solution

The Danfoss Semco water-mist system combines fire detection and fire-fighting to ensure that rather than hope for the fire brigade, a fire can be identified and extinguished before damage occurs. When the sensors detect fire, they shut down the turbine, thus reducing damage to moving parts and isolating the fire, before dispersing a mist of water droplets to tackle the fire. Fitted within the nacelle, and powered by a pump capable of producing 100 Bars at the nozzle, this high-pressure mist evaporates to absorb heat, displace available oxygen and cool the nacelle, all of which starve the fire and prevent the chance of re-ignition.

The challenges

There are a number of challenges to successfully designing and implementing a system such as this. It's not enough that it can extinguish a fire under test conditions, it also has to fulfil the requirements of insurers, wind turbine producers and local authorities. But through thorough research and development and the combination of its fire suppression technology and manufacturing capabilities, Danfoss Semco has been able to overcome these obstacles and develop and roll out system to meets the needs of this growing industry.

Sensors

The first consideration is the origin of any potential fire – the nacelle. All wind turbines have one in which the gearbox, generator, brakes and the various shafts are housed and where technicians gain access to carry out maintenance. However, though all turbines work on the same principles, when it comes to the nacelle, one size definitely does not fit all. So for the system to work its fire detectors have to be tested within and engineered to operate in every specific nacelle space.

Water-mist technology

And like the sensors, the type of fire extinguisher was also informed by the conditions inside the nacelle. As the nacelle presents a challenging

environment of draughts, high humidity and large differences in temperature, identifying the right fire-suppression technology is critical. High-pressure water mist was finally selected following initial tests with gas. Powered by a pump, the mist system offers better coverage and a longer dispersion time than a one-shot gas system powered by a cylinder. What's more, as the pump is powered by electricity and not gas, it eliminates the need for pressure bottles to be stored in the nacelle, taking up space and adding to the potential risks for technicians working on the turbine.

Constant power

To secure this power to the pump, no matter what happens, the system has a triple supply. Connected to the wind turbine and the public power supply, the system also has a battery bank to guarantee it never fails. Charged by the turbine, the battery bank can run the pump for a complete extinguishing period if all other sources of power were lost.

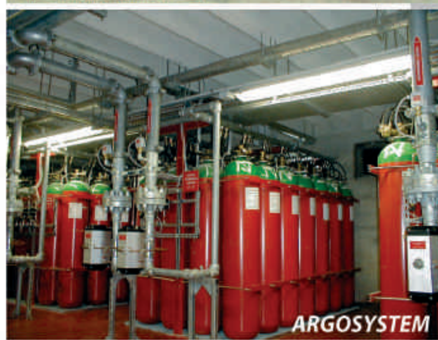
Extra protection

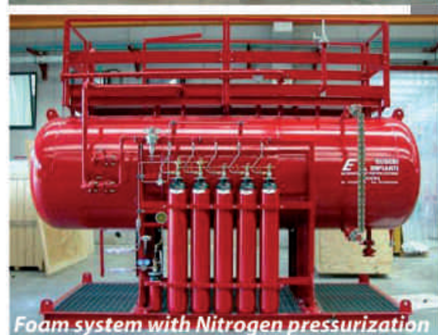
In addition to the Danfoss Semco water mist system to protect the nacelle, a special independent system is also available to protect the hydraulics within the rotating hub. Though often overlooked, its potential fire risk is not to be ignored. Developing fire-fighting systems that could be incorporated into the hub required extensive research and development and was only possible due to strong relationships with and cooperation from wind turbine producers.

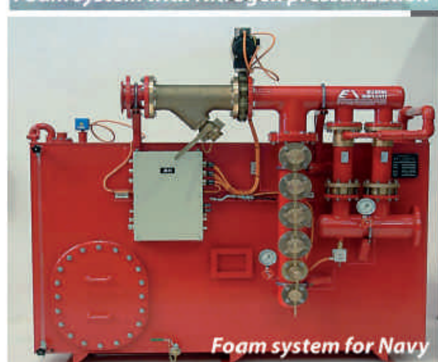
The compact pump system brings several advantages, and is the heart of the system

The future

The growth of wind power shows no signs of abating. 13 countries throughout the developing world are currently undertaking studies with the United Nations in the hopes of adapting wind turbine technology. Meanwhile in the west, the technology is being used more and more in order to reduce carbon emissions in line with the Kyoto Protocol. In Europe, where available land is at a premium, this means the development of offshore wind farms in order to generate 50,000 megawatts of power by 2025. And as the industry continues to develop, particularly at sea where risks are even greater and access is further diminished, so will the demands of insurers and local authorities to install an effective fire-fighting system. It's the only way to ensure that wind power really will protect the environment. IFP







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Protecting High Value Property With Preaction Sprinkler Systems

By Bobby Patrick

Consulting Engineer
Rolf Jensen & Associates, Inc.

Don't throw the baby out with the bathwater!

"I don't want water anywhere near my data center!"; "If this room goes down, it costs us hundreds of thousands of dollars per minute"; "These are priceless artifacts which simply can't be protected with water". Building owners quickly discard the use of automatic fire sprinkler systems in sensitive areas, based on unfounded fears of water damage. Unfortunately, removing automatic sprinkler systems as an option, removes the most reliable form of protection available.

Designers frequently employ clean agent systems to protect high value property, susceptible to water damage. Clean agent systems are gaseous fire suppression systems capable of detecting and extinguishing fires very early in their development. These systems are normally designed to provide adequate suppression without damage to property or occupants. Generally there is little or no clean up after a discharge. Clean agent systems are well suited as a first line of defense. Unfortunately, clean agent systems have significant drawbacks making them less attractive when used alone.

There is a better way. Combining automatic sprinkler systems with clean agent systems is an attractive option. This exploits the strengths, and minimizes the weaknesses of each system. Still not convinced? Read on…

In this article we establish a generic framework to compare and contrast clean agent systems with automatic sprinkler systems. The objective is to survey strengths and weaknesses of each system. Ultimately, we will demonstrate that combining systems, results in more effective protection, improved reliability, and lower costs of ownership than clean agent systems alone.

First let's establish some boundaries on the type of property and fire hazard considered. For the purposes of this article, it is property or spaces a building owner considers irreplaceable or critical to operations. Examples include computer equipment rooms, and historical artifacts holdings. In more technical terms, we are addressing Class A (normal combustibles) and Class C (electrical or electronic equipment) fires. Other types of fires such as Class B (flammable and combustible liquids), Class D (combustible metals), and Class K (cooking oil) require considerations beyond what is addressed here.

Characteristics of Successful Extinguishing Systems

Protecting high value property places emphasis on some key characteristics of fire protection systems. The following questions normally must be addressed by such a system:

1 Does it extinguish or control the type of fire expected?
2 Does it extinguish the fire early in its development?
3 Does it protect against reignition?
4 Does it operate reliably?
5 Does it minimize collateral damage and cleanup?
6 Is it maintainable?
7 Is it cost effective?

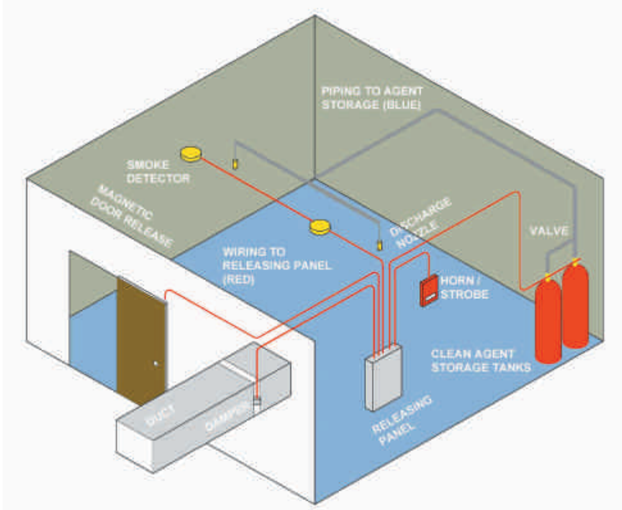
Clean Agent Fundamentals

Clean agent systems generally consist of detection, notification, control panels, piping, tanks, and discharge nozzles. They are usually interfaced to HVAC systems, the main fire alarm panel, automatic door closers, and power systems for protected equipment.

Storage tanks are usually stored near the space protected. The tanks are equipped with a valve (actuator) which releases agent from the tanks into a piping network. The piping network terminates at nozzles that discharge into the protected space.

Detection is a critical piece of the clean agent system. The detection system can take the form of spot type smoke detectors, air sampling systems or even flame detectors. The detection should be suited to the hazard.

The logic or sequence of events is handled by the releasing panel. Normally, the releasing panel monitors the detection system to determine if a fire is present. Upon alarm, the releasing panel may close HVAC dampers, close doors, de-energize



electrical equipment, and open the actuator at the storage tanks.

A critical component of the clean agent system is the integrity of the space protected. The protected space must be constructed so that it can contain the agent during a discharge. Penetrations in the walls, floors, and ceilings must be sealed to prevent leakage. Dampers in HVAC system must close during the discharge. Door sweeps must be installed to minimize leakage. In addition to containing the agent, the protected space must be capable of withstanding the pressure changes that occur during a discharge. This is typically accomplished with carefully designed vent relief system that are tailored to the agent.

Preaction Automatic Sprinkler Fundamentals

Preaction sprinkler systems consist of a deluge valve, piping, closed sprinkler heads, detection and control, an air supply, and a water supply.

Preaction sprinkler systems are a variation of wet and dry pipe sprinkler systems. The primary purpose of preaction systems is to control fire, while reducing the possibility of accidental water release. Preaction systems employ a deluge valve to keep water out of the piping over the protected area until it is needed to control a fire.

Preaction systems depend on two distinct events to occur before water is discharged. First, a detection and control system must provide a signal to the deluge valve. Secondly, a sprinkler head must actuate or "open". These two events can be combined in three four different ways to determine how the system introduces water into the piping. The trade off in each of these schemes is balancing water delivery time with the potential for accidental water discharge.

Non-interlock – If detection devices signal alarm or if a sprinkler head opens, the deluge valve opens and water fills the piping. This configuration provides the fastest discharge of water onto the fire. It is not an optimal solution for high value property susceptible to water damage. If the piping or sprinklers are damaged, water immediately fills the pipe and discharges from the damaged area.

Single interlock – If detection devices signal alarm, the deluge valve opens and water fills the piping. Water will not discharge from the piping until a sprinkler head opens. This provides a good balance between water delivery time and protection against accidental discharge.

Double interlock (electric/electric) – If detection devices signal alarm and a sprinkler head opens, the deluge valve opens and water fills the piping. Both events must occur for water to enter the piping. This configuration provides the slowest response time of the three. It is often used in freezing environments where a false detection can fill the system with water, which in turn can freeze and disable the system.

Double interlock (electric/pneumatic) – The operation of this type system is identical to the electric/electric double interlock system with one main difference. The loss of system piping air pressure is monitored mechanically via a pneumatic actuator instead of electrically via a pressure switch.

The double action system configurations provide the slowest response time.

Evaluating Strengths and Weaknesses

Now, using the framework outlined earlier we will review each item against clean agent and preaction sprinkler systems. Each framework component will be ranked (comparatively) high, medium, or low for each system. A discussion for each ranking is provided.

Does it extinguish or control the type of fire expected?

How effectively can the system extinguish fires expected within the protected space? This purely evaluates the ability of the extinguishing mechanism to control the fire assuming the system operates as designed.

Preaction (HIGH)

Water is the most effective extinguishing agent for fighting the majority of fires (Friedman). It is highly effective at controlling Class A fires and can efficiently control Class C fires when properly installed and maintained (Frank).

On average, where sprinkler systems are installed, property damage was reduced by 53% for office settings and higher in other settings. The average number of fire deaths was reduced by 60% for manufacturing, 74% for office settings, and higher for other properties (Rohr).

Clean Agent (MEDIUM)

Clean agents are selected and designed to extinguish fires expected to occur in a given space. In most cases Class A and Class C fires use identical designs. A key factor in the design of these systems is the selection of the proper concentration of agent. In most cases a 20% safety factor is added to the concentration.

Clean agents are not as effective as water for extinguishing fires. Much scrutiny surrounds clean agents' ability to fully extinguish Class A fires (Robinson). NASA noted that the ability for Halon 1301 to extinguish Class A fires is poor (Robinson) because it doesn't have a substantial cooling effect which may result in reignition once the agent dissipates. It is important to understand that Halon 1301 is generally a more effective extinguishing agent than its current clean agent predecessors.

Does it extinguish a fire very early in its development?

Extinguishing the fire very early limits the impact of fire and smoke. As a fire grows it releases more heat and smoke. High value property protection is

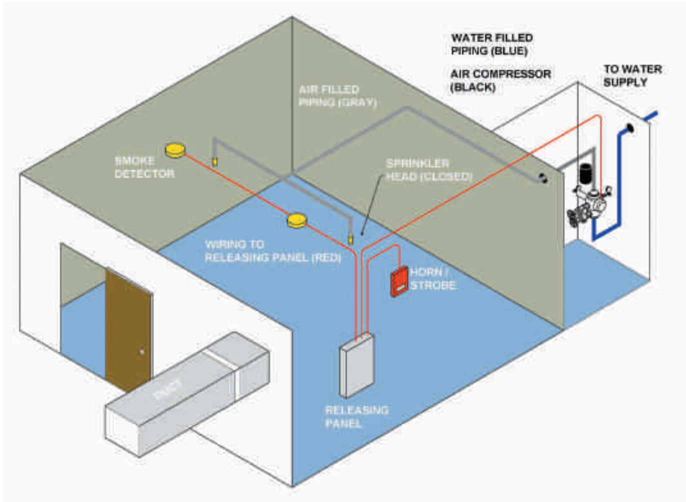
highly dependent on very early detection and extinguishment.

Preaction (LOW)

As pointed out previously, preaction systems depend on two inputs to actually deliver water to the fire. The detection system can be designed to detect fires very early. The same detection systems available for clean agent can be used for preaction systems. So, with early detection we can fill the piping with water. You may remember, however, that no water will be released until a sprinkler head actuates. Sprinkler heads are essentially heat detectors which do not provide very early response. Sprinkler heads do not actuate until significant amounts of heat collect at the ceiling. This results in a very slow response compared to clean agent systems.

Clean Agent (High)

Clean agent systems rely on the detection system for discharge. The sensitivity of the detection system can be adjusted to provide earlier response. Of course there is a trade off between early discharge and the potential for a false or unwanted discharge. Verly early warning smoke detection, such as air sampling, can be used to augment the release detection system but not play a part in the release sequence.Of course there is a trade off between early discharge and the potential for false discharge. Once the fire is detected, clean agents can discharge immediately. Compared to preaction systems, clean agent systems provide a much earlier response to fire.



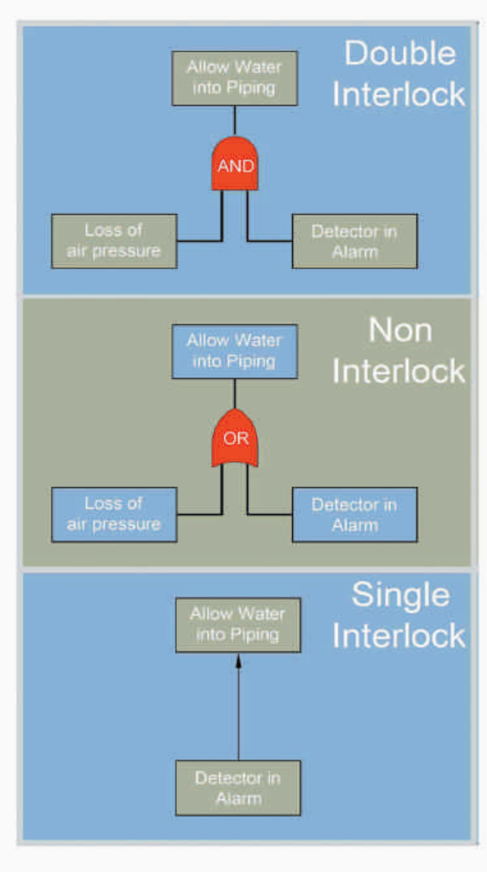
Does it protect against reignition?

If the burning surface is not adequately cooled, flaming can easily resume. The system should provide adequate protection against reignition.

Preaction (HIGH)

Water extinguishes combustion through combinations of the following: cooling the surface, cooling the flame, oxygen displacement (via steam), and blocking radiation (via fog).

Automatic sprinkler systems generally must have at least a 30 minute water supply (including water for manual fire fighting) (NFPA 13, 2002 ed. Table 11.2.3.1.1). Normally these systems are connected to a city water supply which can provide



fire fighting water much longer. After the fire is extinguished the sprinkler system will likely be temporarily turned off to limit water damage. If a fire reignites, the sprinkler system can be reactivated almost effortlessly.

Cooling the surface and providing an abundant water supply provides strong protection against reignition.

Clean Agent (LOW)

Clean agents have various modes of extinguishment. Clean agents generally provide extinguishment through some combination of cooling the flame, chemical interruption of the combustion process, and local oxygen displacement.

If the agent doesn't successfully cool the source of the fire, reignition can occur. For example, if sufficient quantities of Halon agent do not reach the source of the fire in liquid form, cooling does not occur at the burning surface (even though the gaseous flame is extinguished). As the agent leaks out of the room reignition can readily occur (Friedman).

A significant weakness for clean agent systems is that they empty the tank contents immediately. In some cases, a reserve supply is provided. If the initial supply didn't extinguish the fire, the reserve supply may not be successful either.

Does the system operate reliably?

Reliability is the ability of the system to operate under designated operating conditions for a designated period of time or number of cycles (Modarres).

Preaction (HIGH)

Fire sprinkler systems are inherently simple. Their simple construction and means of operation makes them highly reliable. Recent data shows that fire sprinkler systems failed to function in about 7% of structure fires. Two thirds of the failures occurred because the system was manually shut off some time before the fire occurred (Rohr). The majority of sprinkler system failures were actually caused by human intervention, not the system. To be fair, preaction sprinkler systems are less reliable than standard wet pipe systems. This is due to the fact that preaction systems are more complicated and have more failure modes than standard wet systems.

Clean Agent (MEDIUM)

Clean agent systems are more complicated than sprinkler systems. Clean agent systems are subject to more failure modes. To work properly, these systems typically depend on detection, proper control sequence, closing dampers in HVAC systems, closing doors (where closes are employed), mechanical actuation of valves and the ability of the enclosure to hold the agent long enough for extinguishment. Failure at any of these points can cause complete failure of the system. Simply propping open the door can cause complete system failure.

Does the system minimize collateral damage and cleanup?

Preaction (MEDIUM)

The most controversial aspect of using water to protect high value property is its potential impact on the property its self. It has been shown that if a fire is large enough to activate the sprinkler system, the water delivered will not substantially increase damage beyond what is already occurring due to fire, smoke, and manual hose streams (Frank). Water damage caused by fire sprinklers is likely to be less extensive than fire and smoke damage in their absence (Rasbash).

Cleanup after sprinkler discharge can be somewhat more challenging. This requires drying out equipment or property and draining water from the room. Without a sprinkler system, the water (from hose streams) and fire damage cleanup would likely have been more extensive than water cleanup from a sprinkler system alone.

Clean Agent (HIGH)

The strongest selling point of clean agent systems is their minimal collateral damage and cleanup (if any). Most of these agents don't require any significant cleanup.

Is the system easily maintainable?

Preaction (HIGH)

Preaction sprinkler systems only require typical inspections for the alarm and sprinkler systems. These are typical maintenance and inspections generally required within most buildings.

Clean agent (MEDIUM)

Clean agent systems also require typical inspections of the detection and releasing equipment. These inspections are somewhat more involved than typical alarm and sprinkler type inspections. All system interfaces such as HVAC dampers and units must be thoroughly tested.

Most importantly the enclosure integrity must be maintained over time. Very often, penetrations in the walls or above the ceiling are not properly

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Table 1. Impact of Combining Preaction and Clean Agent Systems for Protecting High Value Property

Criterion	Preaction	Clean agent	Combined	Discussion
Does it extinguish or control the type of fire expected?	HIGH	MEDIUM	HIGH	The combined systems provide two lines of defense. Clean agents provide early suppression, while preaction protects the overall structure from catastrophic loss.
Does it extinguish a fire very early in its development?	LOW	HIGH	HIGH	The clean agent system provides early detection and control.
Does it protect against reignition?	HIGH	LOW	HIGH	The preaction system provides complete backup to protect against reignition after the clean agent system has emptied its contents.
Does the system operate reliably?	HIGH	MEDIUM	HIGH	The preaction system provides overall reliability against catastrophic loss.
Does the system minimize collateral damage and cleanup?	MEDIUM	HIGH	HIGH	The clean agent system acts early to extinguish the fire before the sprinkler system engages. If the sprinkler system engages, it provides less collateral damage than the fire and manual fire fighting operations.
Is the system easily maintainable?	HIGH	MEDIUM	MEDIUM	Combining the two systems does not alleviate the need to maintain the clean agent system. Alternatively it doesn't make overall maintenance more difficult.
Is the system cost effective?	HIGH	LOW	MEDIUM	Often, the alternative to combining these systems, is to provide primary and secondary clean agent quantities. This effectively doubles (or more) the amount of agent required on site. Using a single discharge of clean agent (no secondary) with a preaction sprinkler system as backup is significantly cheaper.

sealed. Over time, the ability to hold the agent after discharge degrades.

Is the system cost effective?

Preaction (HIGH)

Preaction sprinkler systems are more expensive than conventional systems because detection systems, and deluge valves must be installed. Compared to other forms of protection, preaction sprinkler systems are highly affordable.

Clean agent (LOW)

Clean agent systems are more expensive than preaction systems primarily due to the cost of the agent. In some cases the agent costs are very low; however, this is offset by more expensive equipment costs (in those cases). Clean agent systems also require that the enclosure be properly sealed, and tested. They require interfaces to various systems such as dampers in the HVAC system and door closers. All of theseThese considerations make clean agent systems relatively expensive.

Conclusion

In most cases, one should not be deciding between sprinkler systems and preaction clean agent systems to protect high value property. Rather, combining the two systems provides the best overall solution (see Table 1). This creates two distinct lines of defense in which each system's strengths compensate for the other's weakness. The two systems, one backing up the other, also buy precious time. The clean agent system can hold a fire in check allowing for possible human intervention. Using a preaction sprinkler system to protect high value property essentially eliminates the risk of accidental water discharge in the protected area. If called upon during a fire, the sprinkler system will actually minimize collateral damage compared to no sprinkler system and manual fire fighting. So, randomly discarding sprinkler systems to avoid water damage is like "throwing the baby out with the bathwater"! Use the right type of sprinkler system to fulfill your project's needs. IFP

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Picture courtesy of Ameron Coatings

Passive Fire Protection:

Structural Steel, Vessels and Storage Tanks in the Oil and Gas Industries

By Ian Stewart

Ameron Coatings

In the oil and gas industries there is always the ever present risk of a major fire. There are two scenarios of fire that may occur in a hydrocarbon-processing complex and both can be devastating. The first is a pool fire and this occurs when a flammable liquid leaks from a vessel or pipeline to form a fluid reservoir, which then ignites. The second and potentially more dangerous type is a jet fire, which can happen following the rupture of a pressurized vessel and or gas pipeline.

A hydrocarbon fire will generate temperatures of more than 1000°C within ten minutes of ignition with heat fluxes of around 150 KW/m^2. A jet fire will exhibit the same temperature rise, but the heat flux could be double that of the pool fire.

There are two types of passive fire protection normally used in hydrocarbon processing complexes, namely cementitious and epoxy intumescent.

Cementitious products are generally based on Portland cement plus exfoliated vermiculite and lightweight aggregates. These products are delivered to the jobsite in sacks or one-ton bags and are mixed with water before being spray or trowel applied. Cementitious materials protect the steel in two ways. Firstly, they contain trapped water of crystallisation, which in a fire situation will be released and keep the steel around 100°C until the water has all been released. The product then acts secondly as an insulator.

Epoxy intumescent coatings are two component, usually solvent free materials, which are delivered to the jobsite in drums, which are mixed together before being spray and trowel applied. In the event of fire these coatings intumesce (i.e. they swell to 4 or 6 times their original thickness) to form a tough insulating carbonaceous char.

The areas that are fire protected to resist hydrocarbon fire in land based oil and gas-processing facilities are, pipelines, vessels, structural steel and storage tanks.

It is important that passive fire protection

Picture courtesy of Ameron Coatings

products are fire tested to the appropriate standard. In the past Hydrocarbon fire testing has been carried out to BS476 Part 20 and 21:1987 following the hydrocarbon time/temperature curve. In America testing is carried out to the Underwriters Laboratory UL 1709 hydrocarbon fire test. Recently, fire testing has been carried out to the European Standard ENV 13381-4:2002 following the hydrocarbon time/temperature curve using the new plate thermocouple to measure the furnace temperature.

In the past Hydrocarbon fire testing has been carried out to BS476 Part 20 and 21:1987 following the hydrocarbon time/temperature curve.

Jet fire testing is carried out in accordance with OTI 95-634 Offshore Technology Report – Jet Fire resistance test. In France a GASAFE test is carried out for the passive fire protection of LPG and LNG Storage tanks.

The passive fire protection material is applied at a thickness to maintain the steel, in the case of structures, below the critical temperature of 550°C. The thickness depends on the steel section size. Typically passive fire protection materials would be expected to delay the collapse of a loaded steel section for 2 hours in a hydrocarbon fire. The higher the mass per linear metre of the steel section, the lower the thickness of passive fire protection will be required for the same time period.

In the case of steel vessels, pipelines and storage tanks consideration has to be given to vessel wall thickness and the likely temperature at which the steel would rupture. The thickness of passive fire protection applied to the surface of a vessel would be related to critical temperature, which is typically 400°C. The process engineer would define the actual critical temperature at the design stage.

The life of the passive fire protection system will always be dependent on using the best primer system to give optimum corrosion protection of the underlying steel. In addition, weather protection and chemical resistance can be improved by using the latest advanced protective coating topcoats e.g. engineered epoxy polysiloxane topcoats.

In comparison, passive fire protection products such as cementitious and epoxy intumescent offer many benefits. The primary benefit being that the fire protection is not reliant on a system that requires activation either automatically or manually. If properly applied by experienced installers, passive fire protection products require little maintenance and thus their whole life cost is low.

The life of the passive fire protection system will always be dependent on using the best primer system to give optimum corrosion protection of the underlying steel.

So whether it's a pool fire or jet fire, there is a passive fire protection solution to a hydrocarbon fire exposure. These solutions in many cases have been in use since the 1970's and now have the track record to complement our knowledge of their long term performance. IFP


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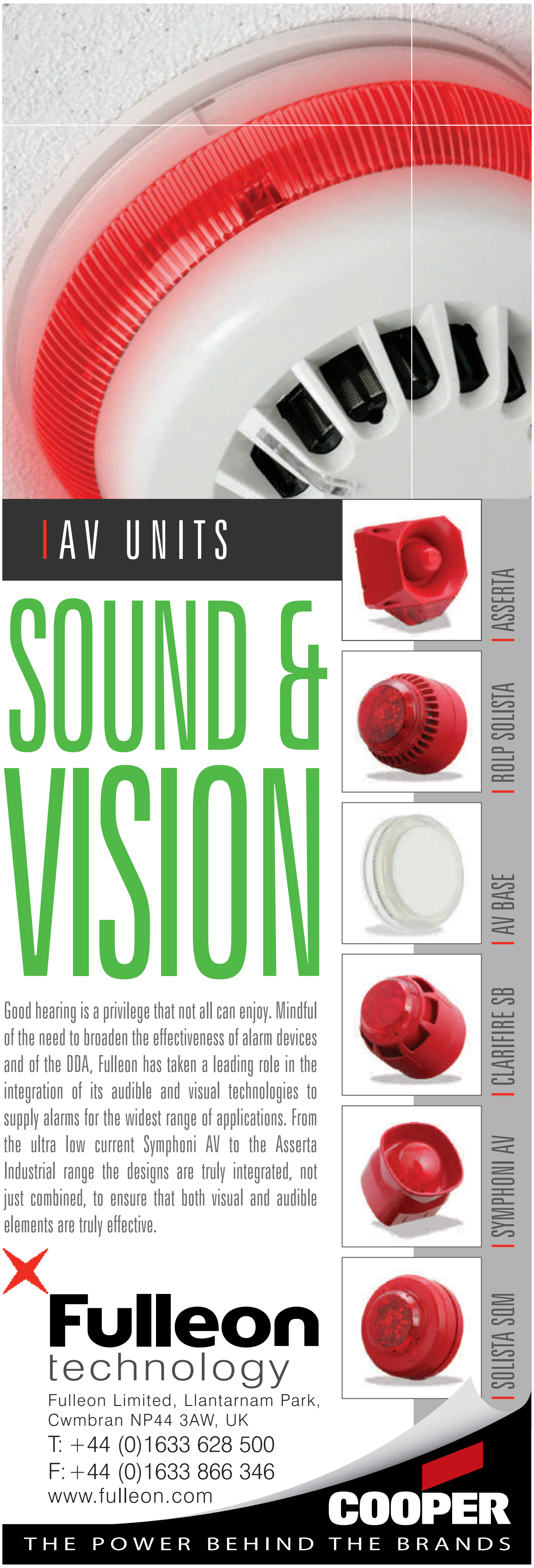
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Post-WTC Management of Emergency Movement from Tall Buildings

An emergency evacuation as a result of fire or other emergency, forces a population into an unusual and stressful situation. The safety of this population requires organisation by emergency managers who determine who needs to act and what needs to be done. This is especially true in tall structures. Without these procedures, the egress routes within many tall structures would be hopelessly overloaded[1,2] and their simultaneous use (primarily staircases) would exceed their design limits.

By S. M. V. Gwynne

Hughes Associates, Inc.

Since the World Trade Centre incident 2001, there have been concerns regarding the response of a population to an emergency procedure. It is feared that there may be some reluctance in following emergency procedures, particularly where sections of the population are expected to remain in the structure while others are evacuated. This reluctance may have always existed, but has become more of a factor since the World Trade Centre incident and the confused and contradictory procedural instructions provided, and the widespread portrayal of this in the media, has brought this issue to the fore.

The concept of the emergency procedure is based on the assumption that a population is receptive to instruction and that they will follow the established protocol. In order to satisfy the need for procedural designs, a speciality engineering discipline has emerged over the past few decades to provide to this need. However, the use of some of the basic tools available to the procedural designer (e.g. the ability to defend in place, to perform phased evacuations, etc.) have now come into question. These new problems can be added to those that have clearly been with us for a while; e.g. getting people to respond when requested, managing their movement, etc. [ref] This article raises some of the problems with managing and designing for the evacuation from a tall building and discusses some remedial actions.

The Procedural Phases

The development of an emergency (and the response to it) is categorised into three broad

phases: Preparation, Notification and Response, and Procedural Implementation. In reality, these phases often overlap and interact with each other.

These phases pose different problems and require different procedural, technological and structural actions in order to address them. In the next sections each of these phases are discussed in terms of the problems that they may pose, the means of addressing these issues and the consequences of failure.

Phase I – Preparation: Implementing an Effective Design

Safety managers and designers employ several techniques to prepare a resident population for an emergency. These include emergency training, documentation, lectures and exercise drills. All of these events occur prior to the event and should take place over a period of time. The preparation for the evacuation procedure is a process that therefore requires assessment, design and reinforcement over a period of time.

In reality, these preparatory measures are often seen by the resident population as a burden. The training is reluctantly attended and the drills avoided if possible. Where drills are announced, residents often take action to reduce the inconvenience of the event. When drills are unannounced, producing more reliable feedback on performance, there is usually an associated degree of resentment. Unfortunately safe preparation is not often given the given the time and attention required. This has consequences.

The preparation for the evacuation procedure is a process that therefore requires assessment, design and reinforcement over a period of time.

To successfully prepare a population and for an emergency procedure to be effective, several key objectives need to be achieved:

- the procedure needs to produce an *efficient* evacuation;
- the procedure should be instilled into the resident population, such that they have sufficient knowledge and familiarity to follow it;
- the population (which may include impaired, intoxication, fatigued, etc.) must be able to perform the actions required of them;
- the population's familiarity with the procedure needs to be maintained;
- and finally, the population needs to have sufficient confidence in the procedure in order to trust it and enact it.

These objectives are inextricably linked. A well-designed, simple procedure that is sufficiently explained on a regular basis is more likely to be understood, and then to be followed. However, it is contended that the first four of these objectives are completely irrelevant unless the final objective is met. This final objective is often overlooked; it is also the most difficult issue to resolve. It is sensitive to issues beyond the fire safety of the structure in question and is not simply about design.

One approach that might be employed to address this problem is to increase the involvement of the resident population during the design preparation. By doing so, and encouraging their input and engaging them throughout, two main advantages may be gained:

1. The designer may gain valuable insight into the actual use of the building from the resident population. This information may be of great value during the design process. For instance, by having a more realistic assessment of the 'normal' use of the building, the design of the procedure can take it into consideration and better cater for it. The greater the similarity between emergency and normal activities, the smaller the adjustment that has to be made by the population.
2. The resident population will be more likely to understand the procedures employed and their underlying assumptions. They will then be more likely to feel part of the design process rather than being subject to it. It may also help the population deal with situations where events have superseded the procedure. By knowing the procedure's underlying principles, they may then be able to adapt in situations where they have to fend for themselves.

Both of these encourage the population to be more engaged and have more confidence in the procedure. This may increase the probability of them following the procedure during an emergency.

Tall structures often have numerous tenants. Depending on their size, these tenants may have their own emergency procedures. The procedures may therefore differ between neighbouring tenants. If there are serious discrepancies between different tenants then several problems may emerge:

1. The procedures may interfere with each other. The design calculations made regarding the effectiveness of these procedures may then not be accurate. Usually these calculations would have been performed without taking into consideration the procedures employed by neighbouring tenants.
2. The sight of alternative procedures being employed may confuse evacuees. They may then choose to deviate from the procedure employed by their organisation. This may disrupt the outcome of the procedure and may detract from the performance of the procedures concerned.

It is therefore vital that an integrated approach is adopted between tenants, or that they at least are familiar with other's procedures. As part of the preparation for an incident, the procedures employed by neighbouring organisations should be taken into consideration. This becomes all the more important when neighbouring tenants employ people that speak different languages. In such cases, it may not be possible to easily establish the procedure being employed during the emergency.

Phase II – Notification and Response: Making People Aware of the incident

Although the emergency procedure should be implemented once notification has taken place, there will inevitably be a delay in doing so – often a significant delay.[3,4,5] The delay may be due to a variety of factors and will be dependent of the

incident scenario. For example, it may involve the population:

- Processing notification; e.g. differentiating the message from other emergency and non-emergency announcements.
- Confirming the nature of the event; e.g. seeking further information, confirming information with colleagues and safety personnel.
- Performing activities that are not part of the procedure; e.g. collecting bags, finishing meal, etc.
- Performing role-based activities as part of the procedures; e.g. shut-down activities.
- Confirming what is required of them.
- Preparing to perform the actions required of them; e.g. determining their first action.

Initially, notification requires that the population diverts their attention away from the activities in which they are engaged. The success of this is initially associated with the clarity of the reception of the alarm signal – is the population physically able to receive the message? Members of the population who do not clearly receive alarm information may misinterpret or ignore the message entirely.[5,6] It then requires them to comprehend the significance of the message provided; i.e. that they receive the message and then accept that it represents an actual event. To attract the attention of the population, the message needs to clearly denote the occurrence of an emergency incident. The population needs to be able to differentiate between the emergency message and other signals from adjacent sound systems (on other floors, from other companies, security alarms, etc.) or background noises.[7] Any difficulty in doing this might significantly hinder their safe progress.

The provision of accurate and timely information to the population is more likely to convince them of an incident than a signal alone and may aid them during their response.

To comprehend the significance of the message, the population must believe that the message signifies a real and imminent threat. The accuracy of this perception is influenced by the frequency with which the alarm system is tested, the frequency of malfunctions, and the frequency of false alarms.[7] If these events occur too frequently then it may detract from the manner in which occupants respond to the signal.[6]

Therefore, notification systems need to be heard, recognised, and believed. Ideally, they should also provide information on the nature of the incident and guidance on the required response, in support of the training provided. For instance, a public address system that is able to clearly inform the population of the nature and severity of the incident leaves less room for misinterpretation than a tone or signal.[8] The provision of accurate and timely information to the population is more likely to convince them of an incident than a signal alone and may aid them during their response. A signal might alert them of an incident, but provide no further information.

There is a misconception that providing timely information will cause the population to panic once they have realised the nature of the incident. This idea has been largely debunked over the last few decades.[3,9-10] Instead, it is now widely accepted that ineffective behaviour is more likely when the provision of detailed information is delayed, ambiguous, or avoided altogether, causing a delayed response.[8] During such a delay, conditions might deteriorate further resulting in less time in which to make a decision and fewer alternatives from which to choose. In contrast, a more informed population is better able to assess the situation and respond accordingly. The same logic is then applied to the evacuee as to the safety manager: timely information helps appropriate actions.

A delay in responding to an incident can have serious consequences.[3,5-7] The longer that the incident has to develop, the greater the risk posed to the resident population. This may involve the loss of potential routes, the worsening of conditions, and the contraction of the procedural timeline. Therefore it is important for the entire emergency response that the population is notified of the incident as quickly as possible, that they believe this message and that sufficient information is provided to them to encourage an appropriate response (i.e. in support of the procedure). The procedure can then be implemented more quickly. Ironically, this quick response is still important even for those who are initially expected to remain behind. They may still be required to evacuate at some stage, and will then be able to do so earlier in the timeline of the fire, when the egress routes have cleared.

Phase III – Getting People to Follow Instructions

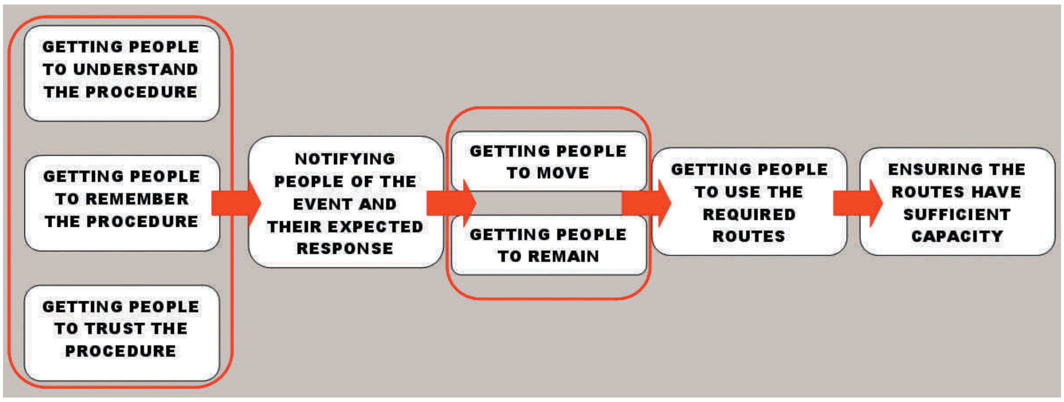
Once the population is aware of the incident and have completed their preparatory actions, they are then ready to respond to the incident. Ideally this would involve them following behaviours allocated to them by the procedure. This might then involve them:

- Moving towards a place of safety (outside or to a refuge). In tall structures this will inevitably involve a sizable portion of the population using staircases.
- Remaining in place until further notice.

There are numerous problems that may arise during this phase of the emergency. It is the most complex and dynamic phase, given that it involves the movement of different sections of the population. If it progresses ineffectually, it is difficult to correct. The problems may be technological, procedural, structural and/or behavioural:

- Are the occupants familiar with the procedure? If not, are there means to inform them of it (e.g. PA systems, staff,etc.)?
- Do the occupants follow the procedure? Is there staff in place to encourage them to do so?
- Is there sufficient capacity for the egress movement to take place? Are there alternative routes available?
- Are the occupants familiar with routes available? Is there wayfinding assistance in place to help them? Is there staff available to intervene to prevent overcrowding?

Simplified Schematic of Key Procedural Design Questions



- Is the capacity available exploited efficiently? Are there means available to manage the use of the routes available?
- Does the incident impinge upon this capacity? Are there staff available to redirect people where necessary or inform them of the conditions ahead?

As mentioned previously, the consequences of the occupants not following procedures are serious. This is true especially where the procedure was specifically designed to prevent overcrowding at critical components in the egress path. If occupants decide not to remain in the building as intended, then the capacity of the staircases employed may be overloaded. This staircase capacity will rarely suffice for a full evacuation. It will have been designed to cope with the simultaneous use of only a section of the population (those deemed to be at the highest risk).

The capacity of the staircases may also be overestimated during the original design of the procedure. Standard calculations generally assume a laminar flow of evacuees along staircase and that the capacity of the staircase increases linearly with the (effective) width of the staircase. These calculations are not able to account for the multitude of factors that detract from flow on stairs. These include:

1. Physical capabilities of the occupants: fatigue, differences in physical capabilities, injuries, interaction with physically impaired occupants;
2. Behavioural factors: people moving in groups, information seeking, searching for friends, counter-flow, resting, talking, etc.;
3. Environmental conditions: presence of smoke, darkness, debris, noise from alarm;
4. Procedural issues: insufficient signage/guidance, presence of emergency personnel, familiarity with various routes.

Although the assumed width of the staircase is often restricted (based on the assumption that a boundary layer is not used[1]) this reduction would still not account for the numerous factors that may detract from performance. This estimation is made less accurate when it is recognised that these factors interact and can then reduce performance still further. Even where more sophisticated methods are used, the representation of staircase movement is still a simplification, excluding many of the most important factors.[11]

If, during the design, the stair flow is set too optimistically, then it may have severe consequences. Primarily, it may lead to insufficient capacity being provided, even assuming that the procedure is followed. This may be exacerbated if more people than expected chose to evacuate or if too many arrive simultaneously at a location; e.g. this may be due to unnecessary delays in the movement of sections of the population. This may delay the evacuation of those deemed most exposed to the incident. It may also mean that populations inadvertently merge at bottlenecks, potentially leading to critical crush conditions being produced. This is especially dangerous when the environmental conditions are deteriorating rapidly.[12]

The four areas identified as detracting from the use of staircase (i.e. the physical, behavioural, environmental and procedural) can be addressed in a variety of ways, although none of the methods presented resolve the problem completely. With our increasing expertise and additional means to examine this performance under numerous scenarios (e.g. applying sophisticated computer models), the procedural designer is now far better able to determine the effectiveness of this measure. However, great expertise is required in order to do this, along with the time and the motivation. The time and resources to explore these issues are not always available and not always sought.

One method of overcoming the physical limitations of the population and the staircase capacity of the structure is to make use of other egress routes already available within the structure; e.g. protected elevator systems.[13] Assuming that elevators are used by the majority of the population to enter a tall structure (i.e. that they are more familiar with the elevators than the stairs), the fire-proofing of these same elevators and their inclusion within the procedure, may compliment the use of the staircases during an emergency. Although the inclusion of elevators within an emergency procedure is not trivial (e.g. where do they stop? How often do they stop? Who gets on?, etc.), elevators may provide extra capacity and a level of redundancy during an incident. For instance, in the event of a staircase being unexpectedly overloaded, elevators may provide additional means of egress that alleviates the overloading on the stairs. It may also provide a means for those will large distances to cover or those with impairments (e.g. the disabled, the injured, the elderly) to leave the structure quickly and without interacting with other evacuees. Even if the elevator system was not considered part of the primary egress routes (i.e. they were only used as secondary routes to assist during overloading or the movement of the impaired). They would be a valuable asset. The use of elevators needs to be

considered in the procedural design.

The behavioural issues highlighted can be aided, although not removed, by training and evacuation drills (see Phase I). During these activities, the likelihood of behavioural 'problems' arising can be better understood and accounted for. The sub-optimal behaviours are not considered an aberration, but an expectation. Therefore, they should be assumed to occur as part of the emergency movement. Provisions can also be made to reduce the impact of declining environmental conditions that may be experienced during the evacuation. For instance, the impact of reduced visibility on movement and wayfinding (e.g. due to light smoke or darkness) can be reduced through light emitting guidance systems.

In both instances, there is a recognition that systems do not always perform perfectly (e.g. smoke can enter protected areas) and that people will certainly not behave exactly as you wish (e.g. they will delay, move slowly, investigate, etc.). Once this is recognised then it is possible to incorporate this into the design. The design should assume sub-optimal behaviours and include fall back positions based on the assumption that some systems will fail. The procedure should still be designed to get people to safety as quickly as possible. However, it should not be based on the unrealistic expectation that everything will go exactly as expected. Therefore some account should be taken of sub-optimal (although not entirely unexpected) events that detract from the performance and some redundancy should be built into the procedure.

Discussion/Conclusion

Many components are required to adequately prepare and respond to a fire emergency in a tall structure. These may involve technological and structural measures. Although vital, these measures can be undermined or not utilised, if the emergency procedures employed are not appropriate or are not followed. The responding population is as important to the outcome of the procedure as those managing the event.

These procedures need to be employed both before and during the event. The designer then has to answer several key questions to appropriately design an emergency procedure (see figure).

The design of an emergency evacuation procedure from a tall structure should both take advantage of the resident population's capabilities and account for their limitations.

The likelihood of the population following a procedure can be influenced by events beyond the immediate control of the designer (e.g. the events of the WTC). Therefore, measures should be taken to engage the population and convince them of the value of the procedure. Just as the population cannot be required to perform unfamiliar and heroic actions as part of a procedure, they also cannot be expected to follow a procedure that they don't understand or trust.

Once the procedure is engaged the designer/procedural managers can provide assistance to aid in the movement of the population. This aid becomes critical if the environmental conditions interfere with the movement of the population, or if routes become overloaded. This can improve the routes available to the population, their movement and in the decisions that they make.

In this article the emergency process was categorised into three phases involving preparation, notification and response, and procedural implementation. All three of these phases require the resident population to be placed at the centre of any designs, calculations and assessments. Although other aspects of the design process may be more reliable and more predictable, the human performance during the emergency will dictate whether it is a success or failure. Therefore, it is this population that needs to be informed during preparation, to be comprehensively notified during the incident, and assisted during their response. IFP

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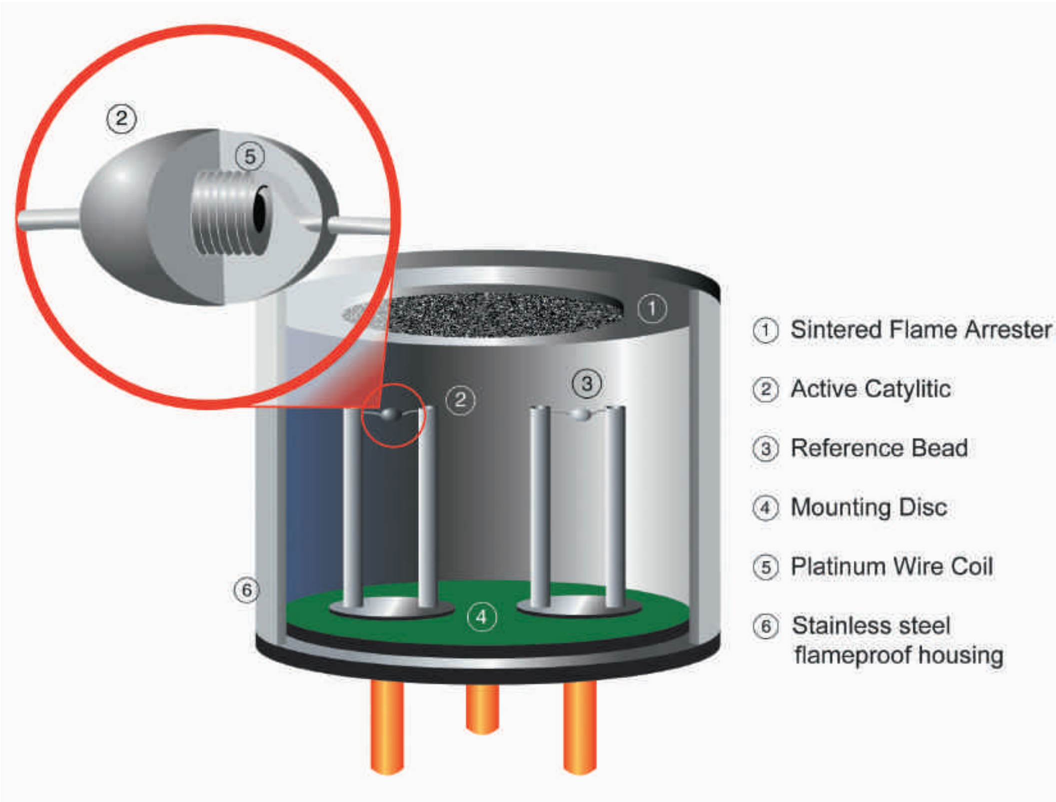
Understanding combustible sensor performance



Picture courtesy of BW Technologies

By Robert E. Henderson

BW Technologies

The potential presence of combustible gases and vapors is one of the most common of all categories of atmospheric hazards. It stands to reason that the sensors used to measure combustible gases are the most widely used type of sensor included in portable atmospheric monitors; especially those used in confined space atmospheric monitoring procedures. In spite of the millions of combustible sensor equipped atmospheric monitors in service in the world, there is still a lot of misinformation and misunderstanding when it comes to the performance characteristics and limitations of this very important type of sensor. Understanding how combustible sensors detect gas is critical to correctly interpreting readings, and avoiding misuse of instruments that include this type of sensor.

What do percent LEL combustible gas sensors measure

In order for an atmosphere to be capable of burning explosively, four conditions must be met. The atmosphere must contain adequate oxygen, adequate fuel, a source of ignition, and sufficient molecular energy to sustain the fire chain reaction. These four conditions are frequently diagrammed as the "Fire Tetrahedron". If any side of the tetrahedron is missing, incomplete or insubstantial, combustion will not occur.

The minimum concentration of gas or vapor in air that will ignite and explosively burn if a source of ignition is present is the Lower Explosive Limit. Different gases and vapors have different LEL concentrations. Below the LEL, the ratio of combustible gas molecules to oxygen is too low for combustion to occur. In other words, the mixture is "too lean" to burn.

Most (but not all) combustible gases and vapors also have an upper limit of concentration beyond which ignition will not occur. The Upper Explosion Limit or UEL is the maximum concentration of combustible gas or vapor in air that will support combustion. Above the UEL, the ratio of gas to oxygen is too high for the fire reaction to propagate. In other words, the mixture is "too rich" to burn. The difference in concentration between the

Picture courtesy of BW Technologies

LEL and UEL is commonly referred to as the Flammability Range. Combustible gas concentrations within the flammability range will burn or explode provided that the other conditions required in the fire tetrahedron are met.

Because the flammability range varies widely between individual gases and vapors, most regulatory standards express hazardous condition thresholds for combustible gas in air in percent LEL concentrations. The most commonly cited hazardous condition threshold concentrations are 5 or 10% LEL. Ten percent LEL is the default alarm setpoint on many instruments. Most combustible gas instruments read from 0 to 100% LEL. For this reason, most combustible gas reading instruments also display readings in percent LEL increments, with a full range of 0 – 100% LEL. Typically, these sensors are used to provide a hazardous condition threshold alarm set to 5% or 10% of the LEL concentration of the gases or vapors being measured. Readings are usually displayed in increments of $\pm$ 1% LEL.

A fire hazard should always be deemed to exist whenever readings exceed 10% LEL. This is the least conservative (or highest acceptable) alarm setpoint for instruments used for monitoring combustible gases and vapors in confined spaces. An important consideration is that many circumstances warrant a more conservative, lower alarm setpoint. The presence of any detectable concentration of flammable/combustible gas in the confined space indicates the existence of an abnormal condition. The only completely safe concentration of combustible gas in a confined space is 0% LEL. In addition, specific procedures or activities may require taking action at a lower concentration.

How combustible sensors detect gas

Most commonly used combustible gas sensors detect gas by catalytically oxidizing or "burning" the gas on an active bead or "pellistor" located within the sensor. While there are numerous variations, the underlying detection principle has not changed for the better part of a century. The catalytic-bead sensor contains two coils of fine platinum wire which are coated with a ceramic or porous alumina material to form beads. The beads are wired into opposing arms of a balanced Wheatstone Bridge electrical circuit. One bead is additionally treated with a platinum or palladium-based material that allows catalyzed combustion to occur on the "active" (or detector) bead. The catalyst is not consumed during combustion. Combustion occurs at concentrations far below the LEL concentration. Even trace amounts of gas or vapor in the air surrounding the sensor can oxidize catalytically on the active bead. The "reference" bead in the circuit lacks the catalyst material, but in other respects exactly resembles the active bead.

A voltage applied across the active and reference beads causes them to heat. Heating is necessary for catalytic oxidation to occur. The temperature required may be as high as 500°C, or in some cases, even higher. In fresh air the Wheatstone Bridge circuit is balanced; that is, the voltage output is zero. If combustible gas is present, oxidation heats the active bead to an even higher temperature. The temperature of the untreated reference bead is unaffected by the presence of gas. Because the two beads are strung on opposite arms of the Wheatstone Bridge circuit, the difference in temperature between the beads is registered by the instrument as a change in electrical resistance.

It is particularly important to verify the calibration of low power combustible sensors by exposure to known concentration test gas on a regular basis. The combustible sensor elements are usually enclosed in a robust stainless-steel housing.

Heating the beads to normal operating temperature requires power from the instrument battery. The amount of power required is a serious constraint on the battery life of the instrument. Recent sensor designs have attempted to reduce the amount of power required by operating the sensor at a lower temperature. While this approach may result in longer battery life, it may also result in the sensor being easier to poison or inhibit, since contaminants which might have been volatilized at a higher temperature can more easily accumulate on the bead. It is particularly important to verify the calibration of low power combustible sensors by exposure to known concentration test gas on a regular basis. The combustible sensor elements are usually enclosed in a robust stainless-steel housing. Gas enters the sensor by first passing through a sintered, stainless steel flame arrestor. The sintered flame arrestor tends to act as a physical barrier that slows or

inhibits the free diffusion of gas molecules into the sensor. The smaller the molecule, the more readily it is able to diffuse through the flame arrestor, penetrate the sintered surface of the bead, and interact with the catalyst in the oxidation reaction.

Catalytic-bead sensors respond to a wide range of ignitable gases and vapors. The amount of heat produced by the combustion of a particular gas/vapor on the active bead reflects the heat of combustion for that substance. The heat of combustion varies from one substance to another. For this reason readings may vary between equivalent concentrations of different combustible gases. As an example, a 50% LEL concentration of pentane provides only about one-half of the heating effect on the active bead of the sensor as a 50% LEL concentration of methane on the same sensor. Another way of expressing this relationship is as a "relative response" of the sensor to pentane. When the instrument is calibrated to methane, the relative response of the sensor to pentane is only 50%. This means that the readings for pentane will be only 50% of the true concentration.

The amount of heat produced by the combustion of a particular gas/vapor on the active bead reflects the heat of combustion for that substance. The heat of combustion varies from one substance to another.

Hot-bead pellistor combustible gas sensors are unable to differentiate between different combustible gases. They provide one signal based on the total heating effects of all the gases capable of being oxidized that are present in the vicinity of the sensor.

Role of flash point in monitoring of ignitable gases and vapors

In order for combustion to occur, the vapor of the substance must be present in the atmosphere. As a general rule, it's the vapor, not the liquid that burns. Vaporization is a function of temperature. Increasing the temperature of the liquid increases the rate and amount of vapor that is produced. The flashpoint temperature is the minimum temperature at which a liquid gives off enough vapor to form an ignitable concentration.

Catalytic-bead sensors, at least when operated in the percent LEL range, may not adequately detect "heavy" or long-chain hydrocarbons, or the vapors from high flashpoint temperature liquids such as turpentines, diesel fuel or jet fuel. Use of alternative types of gas detectors, such as a photoionization detector (PID) may be a better approach if you need to monitor for the presence of these types of hydrocarbon vapors. Some manufacturers suggest that their percent LEL sensors should not be used measure volatile aromatic compounds (VOCs) or combustible liquids with flashpoint temperatures higher than 100°F (38°C). Consult the Operator's Manual, or contact the manufacturer directly to verify the capabilities of the instrument design when using a catalytic-bead LEL sensor to monitor for the presence of these types of contaminants.

Catalytic-bead combustible sensors need oxygen to detect gas

Catalytic-bead sensors require at least eight to ten percent oxygen by volume to detect accurately. A combustible sensor in a 100 percent gas or vapor environment will produce a reading of zero percent LEL. This is the reason that testing protocols for evaluating confined spaces specify measuring oxygen first and then combustible gases and vapors. For this reason confined space instruments that contain catalytic-bead sensors should also include a sensor for measuring oxygen. If the instrument being used does not include an oxygen sensor, be especially cautious

Picture courtesy of BW Technologies

when interpreting results. A rapid up-scale reading followed by a declining or erratic reading may indicate that the environment contains insufficient oxygen for the sensor to read accurately. (It may also indicate a gas concentration beyond the upper scale limit for the sensor, the presence of a contaminant which has caused a sudden inhibition or loss of sensitivity in the sensor, or other condition which prevents the sensor or instrument from obtaining proper readings.) The minimum amount of oxygen that must be present for the sensor to detect accurately is a function of design. Capabilities vary from one manufacturer to another. Users who anticipate using their instruments in potentially oxygen deficient environments should contact the manufacturer for assistance.

Calibration and relative response of combustible sensors

A combustible gas sensor may be calibrated to any number of different gases or vapors. Where possible, the user should calibrate the instrument to achieve the level of sensitivity required for the substances to be measured.

Calibration is a two-step procedure. In the first step the instrument is exposed to contaminant free "fresh" air (that is, air which contains 20.9% oxygen and no combustible gas), turned on, and allowed to warm-up fully. The combustible sensor should read zero. If necessary, the combustible sensor is adjusted to read zero. Instrument manuals and other support materials usually refer to this step as the "fresh air zero."

The second step is to expose the sensor to known concentration calibration gas, and (if necessary) adjust the readings to match the concentration. This is called making a "span adjustment". A "span adjustment" sets the sensitivity of the sensor to a specific gas. Always follow the manufacturer's instructions when calibrating or adjusting the instrument.

Instruments used only for a monitoring a single gas should be calibrated with that particular gas. Calibration choices are more difficult when the instrument may be exposed to a variety of different combustible gases because, as noted previously, equivalent concentrations of different combustible gases may produce different readings. Gases that produce lower relative readings than the gas used to calibrate the instrument can create a potentially dangerous error.

Catalytic-bead poisons and inhibitors

The atmosphere in which an instrument is used can have an effect on catalytic-bead sensors. Poisoning or degraded performance can occur when combustible sensors are exposed to certain substances. Commonly encountered substances that degrade LEL sensor performance include silicones, lead containing compounds (especially tetraethyl lead), sulfur containing compounds, substances containing phosphorus and halogenated hydrocarbons. Combustible sensors can also be affected by exposure to high concentrations of ignitable mixtures.

Poisoning or degraded performance can occur when combustible sensors are exposed to certain substances.

Any conditions, incidents, experiences, or exposure to contaminants that might adversely affect the combustible sensor should trigger immediate verification of the proper performance of the sensor before continued use. This can be done very simply by flowing known concentration test gas over the sensor, and noting the response. If the readings are accurate, the sensor is safe to use. If the readings are inaccurate or out of calibration, the sensor must be recalibrated before further use.

Potential for loss of sensitivity to methane

Age and usage can affect the sensitivity of combustible sensors. Chronic exposure to low levels of poisons or inhibitors acts cumulatively. This usually means that the sensitivity must be increased when calibration occurs. In the extreme, the sensor may require replacement. This again demonstrates that regular calibration is essential to the safe use of combustible sensors.

For many combustible sensors, if sensitivity is lost due to poisoning, it tends to be lost first with regards to methane. This means that a partially poisoned sensor might still respond accurately to other combustible gases while showing a significantly reduced response to methane. This is a particularly important concern for instruments used to monitor atmospheres associated with confined spaces, where methane is by far the most commonly encountered combustible gas.

There are several calibration strategies used by manufacturers to guard against incorrect readings due loss of sensitivity to methane. The first is to calibrate the instrument using the calibration gas

which provides the best level of sensitivity (for instance propane or pentane) and then expose the sensor to a known concentration of methane. The relative response factor for methane can then be used to verify whether there has been loss of sensitivity. This approach increases the time needed to calibrate the instrument and complicates the logistics. Another problem is what to do if there has been a loss of sensitivity to methane.

The second approach is to calibrate the instrument directly to methane. An instrument "spanned" to methane will continue to detect methane accurately even when loss of sensitivity develops. Spanning the instrument during calibration simply makes up for any loss in sensitivity. However, when the sensor is calibrated with methane, readings for most other substances tend to be lower than actual.

An instrument "spanned" to methane will continue to detect methane accurately even when loss of sensitivity develops.

The third approach is to calibrate using methane at a concentration that produces a level of sensitivity equivalent to that provided by the gas of greatest interest. Several manufacturers offer "equivalent" or "simulant" calibration mixtures based on methane, but in concentrations that provide the same span sensitivity as direct calibration using propane, pentane or hexane calibration gas. As previously discussed, 50% LEL pentane produces one-half the heating effect on the active bead in a normally functioning sensor as a 50% LEL concentration of methane. This also means that if you use a 25% LEL concentration of methane, but "span" adjust the readings to equal 50% LEL while the sensor is exposed to this gas, you wind up with a pentane level of span sensitivity, but since you have used methane to calibrate the instrument, you know that the sensor is still responsive to methane.

The fourth approach now offered by many manufacturers is to include a user selectable library of correction factors in the instrument design. In this case, the user simply calibrates using methane, then selects "pentane" or any other correction factor in the library, and the instrument automatically recalculates readings according to the selected relative response. The benefit of this method, once again, is that since methane is used as the calibration gas, incremental loss of sensitivity to methane simply results in the instrument being "overspanned", or producing higher than actual readings for the gas selected from the library of correction factors.

Calibration verifies that sensors remain accurate. If exposure to test gas indicates a loss of sensitivity, the instrument needs adjustment. If the sensors cannot be properly adjusted, they must be replaced before any further use of the instrument. This is an essential part of ownership. IFP

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Picture courtesy of Cafco Int.

Fire protection of storage vessels for flammable liquids

An earlier article in the companion periodical[1] was concerned with storage of hydrocarbons which are well above their normal boiling points at room temperature and therefore have to be stored under their own very high vapour pressure. This article will be concerned with storage of materials which are liquids at ordinary temperatures and therefore have saturated vapour pressures below 1 bar. The whole range of petroleum distillates – gasoline, naphtha, kerosene and diesel – are such. The coverage by Zalosh[2] has been drawn on considerably as has that by Crowl.[3]

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Design principles

When a vessel has to withstand a high internal pressure of vapour it must be designed accordingly, and correlations for determining the wall thickness required apply. These incorporate the vessel dimension, the design stress of the material (units $Nmm^{-2} \equiv MPa$) and the pressure to be contained. If there is a weld allowance must be made for it by means of a 'welding factor' unless the weld has been examined by being radiographed along its length and where necessary re-worked so that the welded seam has the same design stress as the 'virgin metal'. Such precautions need not be taken in the storage of a liquid with a low equilibrium vapour pressure, and a welded seam weaker than the other parts of the vessel wall might in fact be a positive advantage in the event of fire. If such a vessel filled with liquid receives heat from a nearby fire it is better for it to open along the seam and release the liquid relatively slowly and without excessive pressure of accompanying vapour. The alternative is release of the contents catastrophically on vessel breakage and explosion. Similarly, a loose-fitting lid to a vertically orientated vessel containing flammable liquid is a common feature. If there is ignition of the vapour/air mixture above the liquid surface any overpressure due to the

Massive hydrocarbon tank fire in Middle East

confinement will, at worst, blow off the lid but will leave the body of the tank and it contents unaffected. This design is the 'vertical atmospheric fixed roof tank' and can be used for liquids with boiling points up to about 110°C: this boiling range encompasses methanol, ethanol, MEK and toluene.

An advance over the 'vertical atmospheric fixed roof tank' is the 'lifter-roof tank', in which the roof height is adjustable by sliding the roof up or down. These are fairly rare and tanks of the 'floating roof tank' design are more numerous. The floating roof tank is in fact the most widely used design for crude oil and distillate storage. The floating roof, a.k.a. as a deck, is place at the liquid surface and has a rubber or foam seal around it. The 'sealing' which the rubber or foam provides is not total and vapour does escape through it: this is equivalent to saying that such a tank is vented. Some designs of floating roof tank have a fixed roof above the floating one and this provides the seal material with some protection in the event of there being heat from a nearby fire. In the presence of the fixed roof however the system is no longer vented and it is possible for a flammable vapour/air mixture to occur in the space between the floating roof and the fixed one. Because of this the fixed roof is sometimes avoided and replaced with a means of applying foam to protect the seals when necessary.

Tank designs discussed so far have all been vertical. Horizontal tanks, which my be above- or belowground, are used to store liquids including gasoline. Underground tanks require corrosion protection in the same way that buried pipelines do and cathodic protection is the usual approach to this. An electrochemical cell is set up in which the zinc is the anode and the steel of which the vessel is made the cathode. Electrons transfer from anode to cathode, maintaining the condition of the latter to the eventual total loss of the former which is therefore a 'sacrificial anode'.

Inerting

The hazards due to the vapour/air mixture above the surface of a stored flammable liquid can be eliminated by substitution of an inert gas for the oxygen in the space sufficiently to make the gas/vapour mixture there too rich to ignite. One way of bringing this about is to pressurise the space with inert gas and then vent back to atmospheric pressure, an operation which will sometimes have to be carried out several times before the target oxygen concentration is reached. An alternative is 'sweep purging' in which there is continuous flow of inert gas through the space occupied by the vapour at only just above atmospheric pressure until the target oxygen concentration is reached. A depleted storage vessel of liquid is likely still to contain vapour, possibly with air in proportions such that ignition is possible. Such a vapour/air mixture can be removed admitting to the vessel as much water as it will take, whereupon the vapour/air will be confined to the small space above the surface of the water and can be removed with a single 'sweep purge'. As the water is drained out it can be replaced by inert gas, leaving an inerted empty vessel ready for service.

Sprinkler protection of stored flammable liquids

In places including aircraft hangars aqueous film-forming foams (AFFF), made from water, a foaming compound and a surfactant, can be applied by means of a sprinkler system in the event of fire.[4] In general sprinkler systems are used to protect small amounts of flammable liquid, for example paint thinner stored in vessels of volume of the order of one gallon. The intention is that applied water will keep containers of such materials cool in the event of a fire, preventing vapour build-up sufficient for the lids to blow off and the contents to leak.

A case study

One of the best known is the Dayton Ohio fire in 1987 at an automotive paints warehouse.[2] Flammable liquids in a total quantity of 1.5 million gallons were stored in containers of size up to 5 gallons. Smaller containers, some only one pint in volume, were held in cardboard cartons ten of which fell on to the floor during a forklift truck operation. There was container breakage, leakage, ignition and rapid involvement of other containers which on heating blew off their lids and added fuel to the fire. The sprinkler system, the capacity of which was 14 litre per minute per square metre of floor area, hardly had any effect and later rapid release of large amounts of liquid led to fireball behaviour: this was the state of affairs when the fire service arrived.

Concluding remarks

The world produces about 80 million barrels of crude oil per day. This means that crude oil and refined material are constantly being stored. Not all of the crude oil content is used as fuel: some is used in chemical manufacture the preliminary to this usually being cracking. There are other sources of flammable liquid besides crude oil. These include shale products, produced in large amounts in countries including Germany, Australia and Israel. In the US at present there is a move towards ethanol as a motor fuel, usually in blends with mineral gasoline as in E85, automotive fuel comprising a blend of 85% ethanol, balance gasoline. The ethanol is usually made not from petroleum feedstock but from substances such as corn and sorghum, by breaking down the starch to sugars and fermenting. In countries including the US and Thailand natural gas is being used to make liquid feedstock for the chemical industry, and natural gas itself contains appreciable amounts of liquids known as condensate, which can often be blended with gasoline. Quantities of flammable liquids are enormous and their safe storage and handling is a major issue in fire protection engineering. This brief article will provide the interested reader with a suitable introduction and direct him or her to more advanced coverages. IFP

Picture courtesy of Resource Protection International

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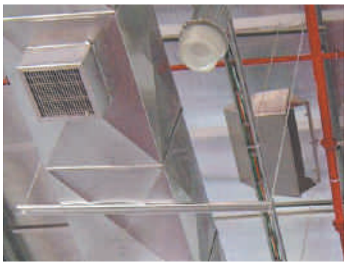
Systems for aircraft hangars

Systems for high risk sites



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Escape Chute Floor Mount. Picture courtesy of Escape Chute Systems

Chutes and Emergency Egress

Escape chutes are typically used on large mining equipment and machinery, passenger cruise ships, silos, air traffic control towers, offshore oil platforms and commercial aircraft (escape slides). The concept of escape chutes was developed more than 100 years ago and since about the early 1980s they have been used as alternative means of egress from multi-story buildings. Escape chutes are commonly used in Europe on tall structures and older heritage buildings where externally mounting fire escape stairs is not possible.

By Robert J. Wheeler, P.E.

Hughes Associates, Inc.

Although the idea of using a chute is not appealing to some, they are growing in popularity. Their use as an alternative means of egress has become even more of an issue after the World Trade Center disaster in which the primary means of escape were rendered unusable. Many questions and concerns have been raised regarding the safe and effective application of escape chutes to multistory buildings. This article summarizes the current uses, limitations and capabilities of escape chutes as emergency egress devices.

Design and Application

Although specific design and operational features of escape chutes vary among manufacturers, they basically consist of (1) the escape chute (generally an inner, middle and outer layer), (2) a storage deployment device and (3) a means to mount them to the building. There is no limit on the height of a chute per se. One of the highest emergency escape chutes is 173 m (568 ft) and according to one manufacturer a 650 m (2,130 ft) chute is currently on the drawing board. Typical installations are for buildings up to approximately 30-stories. To use a chute one sits on the edge of the opening and lowers themselves inside, as shown in the following pictures.

The inner lining of the chute "grips" the person and gravity does the rest. Arms and legs are extended outward to lower the speed of descent and brought in towards the body to increase the descent.

According to one manufacturer the throughput of a chute is around 30 persons per minute and multiple persons can be in the chute simultaneously.


Rooftop Single Entry in use. Pictures courtesy of Escape Chute Systems

The manufacturer also estimates that the chute container could be opened in 15 seconds and the time to traverse the chute for a 10-story building is approximately 40 seconds. The number of persons in a chute simultaneously is a function of the structural integrity of the chute, storage deployment device and the connection to the building. It is recommended that the first person through the chute be a fully trained member of the staff and that another trained member remain at the chute entrance to guide users and control the number of persons entering the chute. When not in use escape chutes are stored in a storage deployment device.

Both single-entry and multiple-entry chutes are in use. A single-entry chute is installed at windows, corridors, balconies or rooftops and is typically used on older buildings where the multiple-entry chute cannot be used. Chutes typically range from 2-stories up to about 200 m (656 ft) and must have a clear and uninterrupted fall to ground level. Multiple-entry chutes are installed inside protected vertical shafts in the building with one chute segment per floor level. Entries into the chute are available from each floor level.

Issues and Concerns

Human Factors

There have been many questions and concerns regarding escape chutes. The primary issue is psychological. How willing (or reluctant) will a person be to use an escape chute from a great height? Factors such as claustrophobia and acrophobia are prime concerns. Most people are familiar with emergency escape slides from aircraft, but would they use them? Most likely, yes. How about an escape chute from a passenger cruise ship? Again, the answer is most likely yes. However, in both of these situations there are few, if any, other alternatives to quickly and safely evacuate the spaces. Also in these situations personnel that are trained in emergency evacuations and the use of these devices are available to provide assistance and direction.

Increased attention is focused on the evacuation of Very Large Transport Aircraft (VLTA); specifically, how willing will a passenger be to jump onto an escape slide from the upper deck of an aircraft that may be as high as 11.5 m (38 ft) above the ground. Conclusions of one study have shown an increased exit hesitation time of passengers. Although the study did not directly address the use of emergency chutes from tall buildings the psychological effects are similar. Imagine a person on the 10th floor of a building being asked to step into an escape chute. Also, evacuees are not able to see out of an escape chute. While this may help in alleviating the visual effect of height, will it contribute to a sense of claustrophobia, resulting in a fear of using the chutes under emergency conditions? Studies of human behavior relative to using these devices are needed prior to widespread installation.

Ergonomics

What is the target population for whom escape chutes are designed? A design to accommodate all ranges of possible sizes and physical capabilities of potential evacuees may be impossible. One manufacturer reported that the youngest user would be about 6 or 7 years old. The entrance to one chute

is approximately 600 mm (2 ft) in diameter and has been successfully used by men weighing approximately 150 kg (330 lb). However, an individual of this size has been shown to slow down the throughput of the chute. At a certain point a person's size can preclude their use of a chute, or lead to a blockage or failure as subsequent evacuees pile up. There is a danger of skin burns on knees, elbows and heads; the longer the chute the greater the burn. In turn, this may result in evacuees that are slow to move away from the base of the chute upon reaching the ground level so that other evacuees can exit.

Rooftop Moveable Platform – GPO Building. Picture courtesy of Escape Mobiltex (S) Pte Ltd

Regulations

Escape chutes are not required by any of today's building or fire codes, making their use voluntary and at the discretion of building owners. Consequently, building owners, manufacturers and Authorities Having Jurisdiction are making decisions on the design, installation and approval of systems without a set of standards or requirements. In spite of growing interest, should this information be included in codes prior to any standards being developed that govern them? Standards development may be necessary if for no other reason than to provide a consistent, uniform set of criteria.

The American Society of Testing and Materials (ASTM), Subcommittee E06.77, High Rise External Evacuation Devices is developing standards for three types of devices:

- Platform Rescue Systems (PRS),
- Controlled Descent Devices (CDD), and
- Chutes Devices (CD)

Rooftop Single Entry – Roof Entrance. Picture courtesy of Escape Chute Systems

Standards are required that address such issues as reliability; operation in adverse weather conditions; structural loading; communications during evacuation; size, age and physical limitations of evacuees; and quality of materials.

The National Fire Protection Association has also considered recognizing these types of systems. The NFPA Technical Committee on Means of Egress developed potential code language defining and recognizing escape devices and systems as supplemental evacuation devices in NFPA 101, *Life Safety Code*, and NFPA 5000, *Building Construction and Safety Code*. Language addressing escape devices made its way through the NFPA committee after much debate and was sent to a vote at the full members meeting in 2005. At this meeting the issue was voted down and is therefore not included in the current code revisions.

Training

Who should be trained, to what level and how often should training be held? One manufacturer provides a 4-day training course for new installations. This enables the training of eight (8) future trainers and 250-300 end users. However, with potentially large occupant turnovers and daily visitors to buildings more frequent training may be warranted for building owners, occupants, and fire department personnel. Should training also be extended to include visitors to buildings with escape chutes and to what extent?

Maintenance and Inspection

The extent to which escape chutes should be inspected and maintained must be considered. Experience with other fire protection and life safety systems indicates that inspection and maintenance of installed systems is one area that is often overlooked. One manufacturer recommends an annual inspection by a local agent and an inspection by the manufacturer every 5 years.

Deployment

In emergency situations occupants of a building, when given a choice, tend to utilize the same route to exit a building as they do to enter the building. For multistory buildings this generally will be the stairs located at the core of the building. How effectively can occupants be redirected to locations of escape chutes?

In addition, a decision must be made whether to deploy single-entry escape chutes immediately to supplement existing means of egress or as a last resort when other means of egress become compromised. Deployment of a single-entry escape chute as a supplementary means of escape some time after the start of a building evacuation may require occupants to reverse their direction of travel in order to use the chute. This poses obvious logistical problems relative to crowd movement. Single-entry escape chutes extending to ground level require a run-out distance at ground level to allow evacuees using the chute to slow before exiting. The run-out distance may be affected by emergency response apparatus.

Another problem during use of evacuation chutes will be communications between the entrance point and termination of the chute, whether at ground level or another level of the building. Effective communication will be necessary to properly monitor the flow of personnel through the device.

Conclusion

Escape chutes have been shown to be effective and accepted as emergency egress devices in certain applications including buildings. However, as their application in multistory buildings, and especially high-rise buildings increases, the study of human factors relative to their use should be considered.

Although the use of an escape chute is as an alternative and supplemental means of egress, a uniform set of standards and criteria is needed by which these devices are manufactured, tested and approved. Inclusion of escape chutes in building codes and standards will also provide uniform guidance on the selection, design and installation, training and maintenance of these devices. IFP

Fire protection – the important third!!

ASFP
ASSOCIATION
FOR SPECIALIST
FIRE PROTECTION

Third party accreditation, the third man and the third way. Do you know the difference? Which one is associated with Harry Lime, which with Tony Blair and last but not least, which is **not** associated with either of the other two?

By The Association for Specialist Fire Protection (ASFP)

You might have thought the question easy. I mean, of course, zither music and post war Vienna are obviously not Tony Blair as he's not old enough, is he? On top of that, Tony Blair is a real person and Harry Lime is a figment of Graham Greene's imagination that was brought to life in the cinema by Carol Reed. But what was the name of the movie?

Enough of the confusion. Harry Lime was the recently dead guy in the film-noir classic 'The Third Man' and Tony Blair is an adherent of 'The Third Way' in politics.

You may ask why the aforementioned diatribe has been included. Well, it serves to illustrate the extent of the confusion in the construction market when it comes to the remaining 'third' item – 'Third Party Accreditation'

The ASFP assumed, perhaps naively, that most people in the construction industry understood the concept of third party accreditation for installers of fire protection systems. However, a survey carried out by the ASFP contractors' committee found that there was a lot of confusion in the market and in particular, from the main contractor and property developer base. Thus, its time for a basic course in the nomenclature!

You may well ask why the market should have any knowledge of the term? For that answer turn to 'Approved Document B' (ADB) of 'The Building Regulations 1991 – 2000 Edition' which says:

'Since the performance of a system, product, component, structure is dependent upon satisfactory site installation, testing and maintenance, independent schemes of certification and registration of installers and maintenance firms of such will provide confidence in the appropriate standard of workmanship being provided.'

The ASFP assumed, perhaps naively, that most people in the construction industry understood the concept of third party accreditation for installers of fire protection systems.

And….

'Third party accreditation and registration of installers of systems, materials, products or structures provide a means of ensuring that installations have been conducted by knowledgeable contractors to appropriate standards, thereby

increasing the reliability of the anticipated performance in fire.'

In addition, the ASFP was especially encouraged to see the following proposed wording in the recent ADB consultation document with regard to third party accreditation schemes for the installation of fire protection systems:

'Schemes such as those mentioned above may be accepted by Building Control Bodies as evidence of compliance. The Building Control Body will, however, wish to establish, in advance of the work that the scheme is adequate for the purposes of the Building Regulations.'

The Association for Specialist Fire Protection (ASFP) strongly believes that these statements from ADB are the 'best practise' that the construction industry should be striving for to ensure the highest level of fire safety of the UK's buildings. Indeed, all ASFP installer members are third party accredited or working towards third party accreditation.

So where does the market's confusion come from? Well, many respondents to the survey thought that approved or recognised applicators, as appointed by product manufacturers, were in fact third party accredited! This is not of course to say that product manufacturers don't train their installers properly, but such training does not extend to them randomly inspecting the installed product on-site!

The Association for Specialist Fire Protection (ASFP) strongly believes that these statements from ADB are the 'best practise' that the construction industry should be striving for to ensure the highest level of fire safety of the UK's buildings.

Some other companies that replied to the survey thought that the carrying of CSCS (Construction Skills Certification Scheme) Cards by the operatives meant that their company was third party accredited. CSCS aims to register every competent construction operative within the UK not currently on a skills registration scheme. Operatives will get an individual registration card (similar to a credit card) which lasts for three or five years. The CSCS card also provides evidence that the holder has undergone health and safety awareness training or testing. The CSCS initiative is supported strongly by the ASFP, but the scheme registers operatives and not companies and does not provide any inspection of work or company systems.

The ASFP has been heavily involved with the Construction Industry Training Board (CITB) in the design of the Level 2 and 3 NVQs in Passive Fire Protection. Level 2 is for installation operatives and Level 3 for supervisors. These NVQs demonstrate the competence of the employee and this is assessed by on-site visits. It is the latter that has led to the confusion in some quarters that these constitute some sort of accreditation/inspection – **it does not!** This NVQ demonstrates that the holder has been assessed to have a basic competence level in at least two out of the seven possible fire protection modules. The seven modules currently include the application/installation of structural cladding, intumescent coatings, fire rated ductwork, fire stopping and penetrations/cavity barriers, fire rated walls and linings, fire rated ceilings and spray applied materials. The NVQ is a valuable tool in looking at the competence of a company's workforce but it does not ensure that the work on-site will be of the standard required by the client.

So, we've looked at what third party accreditation is not, so what is it?

The CSCS initiative is supported strongly by the ASFP, but the scheme registers operatives and not companies and does not provide any inspection of work or company systems.

In the opinion of the ASFP third party accreditation schemes mean a combination of site inspections, quality management system audits plus the assessment of the competence of the workforce. Such schemes ensure that passive fire protection installations have been conducted by knowledgeable contractors to the appropriate standards. In addition, these schemes offer a meaningful certificate of conformity that is backed by a third party (the scheme organiser) and this will add confidence to the client that the passive fire protection in his/her building has been installed properly. Given the increased responsibilities of the 'Responsible Person' under the up and coming Regulatory Reform (Fire Safety) Order, it would seem sensible for them to insist upon the use of third party accredited installers for the passive fire protection in their buildings.

In the opinion of the ASFP third party accreditation schemes mean a combination of site inspections, quality management system audits plus the assessment of the competence of the workforce.

So, remember there is no space for naivety or confusion in the installation of passive fire protection. It's a life safety item and as such, in the opinion of the ASFP, should be installed by a third party accredited installer.

The Third Man won an Oscar for cinematography. Tony Blair and the 'Third Way' have won three General Elections. Surely now it's time for 'Third Party Accreditation' for installers of fire protection systems to win through in the minds of the main contractor and the property developer? IFP

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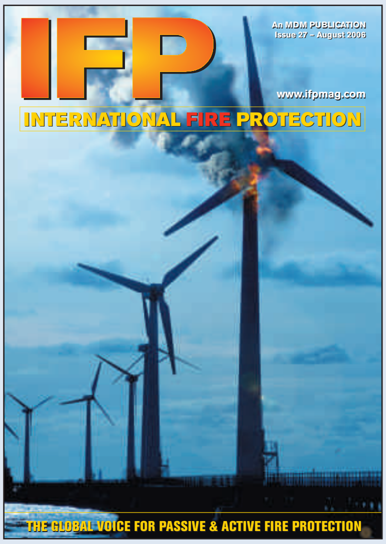

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* 67 Fed. Reg. 77927 (Dec. 20, 2002)

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INTERNATIONAL FIRE PROTECTION

THE GLOBAL VOICE FOR PASSIVE & ACTIVE FIRE PROTECTION

November 2006
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Front Cover Picture: VESDA Aspirating Smoke Detection protecting the decommissioned Concorde aircraft at the Museum of Flight in East Fortune. © Vision Systems Europe Ltd

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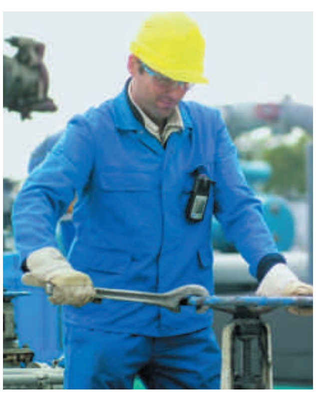
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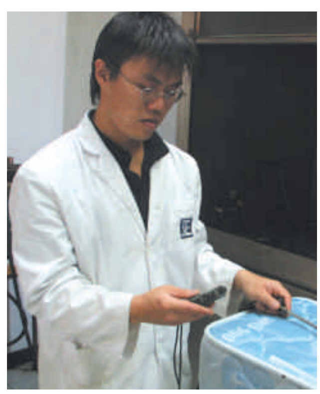
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Pyro Mi cables successfully witness tested to the stringent fire test methodology of BS7346-6:2005

TYCO THERMAL CONTROLS has led the way by example in having its Pyro MI mineral-insulated cables undergo Lloyds Register witness testing under the new, more stringent, fire test methodology of BS 7346-6:2005. This cable successfully achieved the highest performance requirement of 120 minutes survival time for fire fighting systems. The Standard applies to cables above a notional size of 20mmØ, but also recognises smaller cables that can be accommodated in the test rig. As many MI cable sizes typically used for life safety and fire fighting circuits are significantly smaller and lighter than other cables of an equivalent rating in the Standard, Tyco Thermal Controls also took the opportunity to subject Pyro MI cables down to12mmØ to the same rigorous tests and were able to demonstrate that these too will meet the highest fire performance requirements.

BS 7346-6:2005 is the recently introduced Standard for fire-rated cable systems, defining the performance requirements of various types of fire-rated cables (up to 600/1000V) in maintaining circuit integrity for life safety, fire-fighting and property protection systems under fire conditions.

With the introduction of BS7346 in respect of fire-rated components, and specifically in Part 6 – Specification for cable systems, the British Standards Institute addressed the long standing concerns with respect to fire test methodology.

These had been earlier recognised in the commentary to BS 5839-1:2002, for fire alarm cables that identified a need for revision of the test methods of BS 6387 (for which the test rig is limited to smaller cables up to approx 20mmØ) to more accurately replicate the physics of a real fire scenario.

BS 7346-6:2005 introduces new test methods to assess cable performance under conditions of direct application of fire, direct mechanical impact and fire-fighting water shock – all conditions associated with a real fire incident. Where previously each element of a test was conducted on a separate cable sample, this Standard requires the complete test to be applied to a single cable sample and, for the first time, it is subjected to direct mechanical shock and water jet impacts.

The test methodology has been devised, for a single cable sample, to validate that the fire-rated cable will maintain circuit integrity for the required survival time whilst simultaneously:

- withstanding a constant temperature attack at 842°C.
- withstanding repeated direct impact shock of approx 10N at 10 minute intervals.
- withstanding direct water jet impact equivalent to a 2 bar water hose at the point of mechanical impact during the last 5 minutes of the required survival time.

The BS 7346-6 Standard describes two classes of system, Life Safety and Fire Fighting which, when applied, determine the appropriate performance requirement according to the function of each circuit.

Life Safety requires control systems to remain functional for alarm and to support evacuation. Suggested survival time requirements assessed as being for instance 30 minutes for single stage evacuation or 60 minutes for multi-stage evacuation.

Fire fighting systems require circuit integrity for 120 minutes to serve active systems for protecting and assisting fire-fighters in carrying out their role and would typically include pressure differential systems for fire-fighting, smoke and heat exhaust ventilation, sprinklers and fire fighting lifts.

Contained in the Standard are a table and an annex which provide a matrix of suggested survival times to meet different fire performance objectives. Obviously, if for practical reasons a single cable type is to be employed for all applications then it would need to have the maximum fire survival performance to maintain full system integrity.

Most active fire safety systems in buildings rely on a dependable electrical power supply for detection, alarms, evacuation and communication thereby enabling safe evacuation and assisting the fire fighting response. In the event of fire it is critical for electrical circuit integrity, for power, signal & control, to sustain operation systems incorporating equipment such as, sprinkler pumps, shutters and smoke curtains, smoke ventilation systems, fire fighting lifts, smoke control dampers and pressurisation fans. The electric cables which maintain power, control and signals to such equipment are fundamental to the task.

By introducing a more accurate replication of fire dynamics into cable test methodology and classifying objectives, BS 7346-6 offers fire safety engineers a meaningful guide to the capability of different fire performance cables in respect of their application.

Within the new Standard, building services engineers and fire engineers, responsible for specifying fire-rated cable systems into ever more complex buildings, are provided with clear guidance for the selection of appropriate fire-rated cables to support Life Safety and Fire Fighting applications.

BS 7346-6 is available now from BSI
www.bsi-global.com

For more information:
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Fax: +44 0800 968624
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Reliable's DH 56 & Dry DH56 Sprinklers

Light Hazard, Extended Coverage for Decks, Halls or Rooms

By James A. Mikkila

The Reliable Automatic Sprinkler Company has introduced an exiting new product as a compliment to their popular DH80 Deck/Hall sprinkler.

James A. Mikkila
James (Jim) Mikkila has been actively involved in the fire protection industry for almost 30 years, with experience in both the fire sprinkler and fire alarm industries. Jim's career started in 1978 working, as a Contract Representative, for "Automatic" Sprinkler Corporation of America estimating and selling fire sprinkler systems. He later moved to the manufacturing side of "Automatic" Sprinkler as a Product Manager, working with the R&D group to introduce and market new products for fire sprinkler systems. In 1993, Jim began working for System Sensor as National Sales Manger for their line of fire sprinkler monitoring devices and later became Director of Sales East for the Security Business Unit, managing the sales efforts for their line of smoke detectors and notification devices. He has been with Reliable Automatic Sprinkler Company since July of 2006 and is actively involved in educating the engineering community about the benefits of utilizing Reliable's products. Jim earned an undergraduate degree from Ohio University in Business Administration and a Master of Business Administration (MBA) from Baldwin-Wallace College. Jim is based in Strongsville, Ohio, a suburb of Cleveland.

For more information contact:
The Reliable Automatic Sprinkler Co Inc
Tel: +1 9146683470
Website:
www.reliablesprinkler.com

The DH56 is Listed by Underwriters Laboratories Inc. (UL) and UL certified for Canada (cULus) as a quick response extended coverage horizontal sidewall sprinkler for light hazard occupancies. The use of a 3mm bulb allows quick response which enables the sprinkler to apply water to a fire sooner than standard response sprinklers of the same temperature rating.

The unique deflector incorporated in the DH56 allows for a discharge pattern that protects a coverage area of 28 feet (8.5m) wide by either 8 feet (2.4m) or 10 feet (3m) deep. The DH56 sprinkler incorporates a 5.6 (80) K Factor that requires less pressure and water flow than the original Deck/Hall sprinkler, the DH80.

Reliable has incorporated the K Factor (5.6) into the model number of this sprinkler (DH56) and will incorporate the K Factor into the model numbers of all new sprinklers that Reliable introduces to the fire sprinkler industry. Reliable has been incorporating the K Factor into the sprinkler model for about four years now and this decision will make it easier for the engineer, designer, and installing company to identify the optimum sprinkler for the hazard classification

The DH56 extended coverage sidewall sprinkler allows for the designer or engineer to design 1 sprinkler instead of 2 and for some drop ceiling and recessed doorways may replace more than 2 sprinklers. The DH 56 sprinkler can protect long and narrow spaces such as hallways, corridors, decks and rooms up to 28 (8.5m) wide and 10 (3m) long. Additional design flexibility is found with a deflector to ceiling distance from 4 inches (102mm) minimum to 12 inches (305mm) maximum. This design flexibility allows efficient routing of piping to allow for structural or mechanical interferences by other trades.

The DH 56 sprinkler can be utilized with a one piece escutcheon, in a recessed escutcheon, or fully concealed with a white cover plate to obtain the finished look that you desire. Sprinkler finishes are available in white or chrome and the recessed escutcheon comes in white, chrome, and bright brass. The recessed and fully concealed versions allow for a generous ½" (13mm) adjustment of the escutcheon and cover plate. The concealed cover plate can help prevent the sprinkler from mechanical damage and from being used for unintended purposes.

High pressure systems do not present a problem for the DH56. Approved for 250 psi (17,2 bar) applications, the sprinkler can be used in higher pressure systems where pressure reducing valves are to expensive or not practical.

Model DH56 is also available as a dry sidewall sprinkler and is intended for use in enclosed dry and preaction systems and in enclosed areas subjected to freezing temperatures, such as unheated corridors and vestibules. Exterior balconies that are required to have sprinklers installed are an excellent use for the DH56 dry sidewall sprinkler. Environments wherein dry sprinklers are employed can be corrosive. For this reason, the Model DH56 dry sprinklers have a special wax fillet placed in the gap between the cup that supports the bulb and the wrenching boss. This wax will not interfere with the operation of the sprinkler, and it prevents contaminants from entering the internal portion of the drop nipple. The wax is not intended to be removed after installation of the dry sidewall sprinkler.

DH56 chrome recessed

The DH56 will be especially useful for long corridors, when the 2007 National Fire Protection Association (NFPA) Pamphlet #13 takes effect. Section 11-2.3.3.7 of the 2007 NFPA #13 will allow designers and engineers to calculate 75 lineal feet along a corridor that has protected openings. This will reduce the corridor hydraulic calculations to a mere three DH56 sprinklers in lieu of the current requirement to calculate five sprinklers.

Bulletin 015 for standard sprinklers and bulletin 016 for the dry sidewall sprinklers provides all of the technical information that is required to utilize the DH56 Deck/Hall sprinkler for your standard or unique design challenges. Bulletin 015 and 016 are available to be downloaded from the recently revamped Reliable web site at www.reliablesprinkler.com. The new revamped web site provides a more user friendly interface to locate the information that you desire.

The Reliable Automatic Sprinkler Company is committed to providing the fire protection community with the most technologically advanced quality products, backed up with the best customer service in the industry. IFP

System Sensor

Advanced multi-sensor detector technology will help reduce automatic system false alarms

In 2005 more than 280,000 false alarms in the UK were attributed to automatic fire systems, wasting the Fire and Rescue Service's time. With the cost of evacuating an airport, a shopping centre or a major financial institution running to hundreds of thousands of pounds per minute when the building is empty, the problem also has significant direct financial implications for business owners in addition to the disruption caused to their staff and customers occupying the premises.

By Stuart Ball

System Sensor Europe

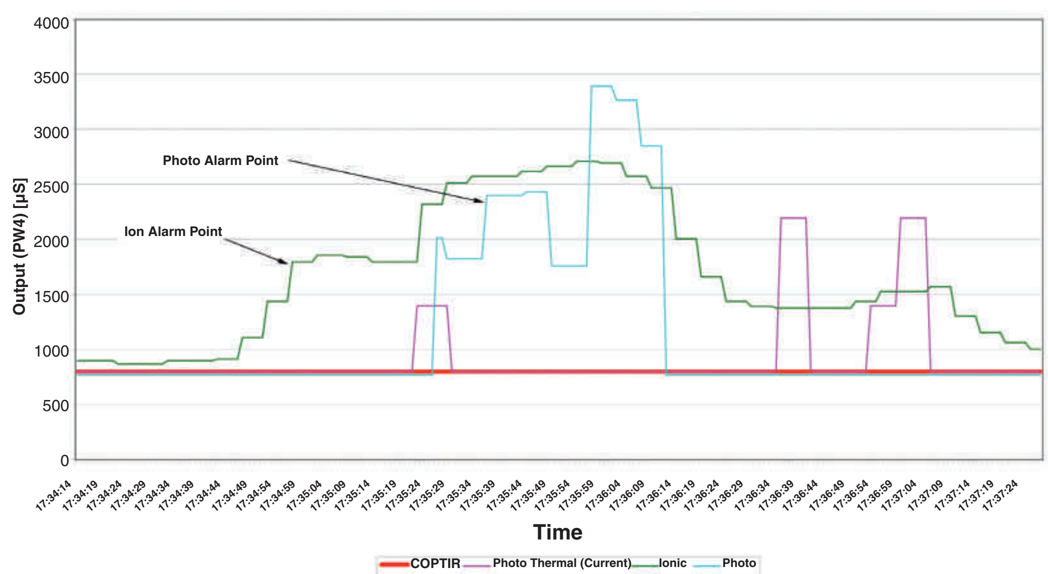
The major detector manufacturers are continually developing new detection methods and improving existing technologies in order to provide better performance. The ultimate goal of instantaneous detection of a real fire combined with zero false alarms arising from environmental disturbances is unlikely ever to be realised, but the performance of today's fire detectors is several orders of magnitude better than was available only a few years ago.

Multi-sensor detectors have been one of the primary methods used to improve detector performance; they are now offered by all major manufacturers. Photo-thermal devices are now widely available and perform well; fairly recently CO gas, optical and thermal devices have been announced, claiming a further performance increase. Continuing the move to increased sophistication, System Sensor has developed COPTIR, a unique development that moves detector false alarm immunity and fire detection performance to a new level. With widespread implementation in the field, it is expected that there would be a dramatic improvement in false alarm statistics in the future.

The unique four sensor detector, COPTIR

It is well known that every fire has a different profile during its development. At one extreme a slow smouldering fire may never generate much heat, but will produce large amounts of smoke, while at the other end of the spectrum, a pure alcohol fire generates relatively high temperatures very quickly without any evidence of smoke. This variability is recognised by the various Standards bodies throughout the world, all of whom define a series of standard test fires, designed to ensure that any detector should offer a sufficient performance to the wide type of fires that my be encountered in the field. Their response must be within the predefined parameters when tested under laboratory conditions. The European bodies label their set of test fires as TF1 – TF6.

However variable the fire, and however different are the characteristics of the inflammable material, all fires have three elements in common: they all produce carbon monoxide, heat, and particulate matter. The proportions change from one fire to another, as does the time for each phase, but in every case, to a greater or lesser



Steam nuisance test

Europe:

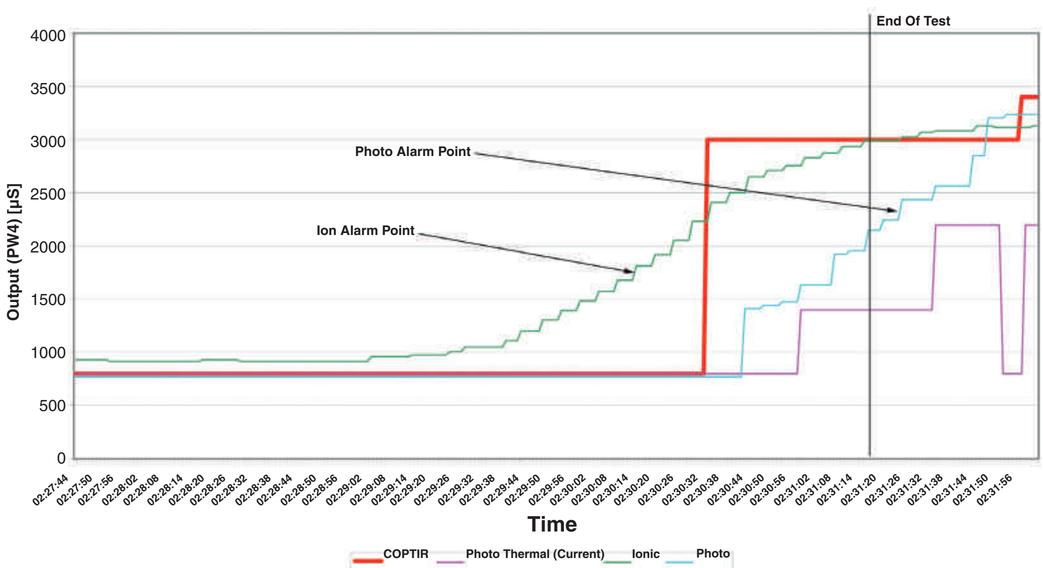
extent, each of these three elements will be present, although in many phases the amount of each of the three elements may be very small. In cases where the fire is flaming, it will also produce a changing light signature as the result of the flame generation.

This was the starting point for the development of the COPTIR multi-criteria fire detector. It combines four independent sensors: a carbon monoxide sensor, a photoelectric smoke sensor, a temperature sensor and an infra-red light sensor, all managed by an embedded microprocessor running a set of very sophisticated and responsive algorithms in one low profile housing. By measuring and processing the individual sensor outputs with intelligent algorithms, a multi-sensor detector has been developed that is ultra-immune to non-fires and yet very sensitive to fires.

It has long been recognised that as a single sensor device, smoke detection is the most important early warning fire detector. However, due to its principle of operation, it is also prone to false alarms, particularly if installed in unsuitable environments. For this reason, it is important to recognise that although COPTIR monitors each of the four major elements of a fire, not just the generated particles, it is a fire detector, whose decision is based on enhancement of the smoke detection element. It is this fundamental difference that sets COPTIR apart from any other product on the market, moving the science of early fire detection onto a far higher level. The integration of continual monitoring of all four major elements of a fire has enabled the creation of a detector that responds far more quickly to an actual fire, has high immunity to nuisances and is highly configurable from the panel, allowing the detection system to be profiled to changes in the use and occupation of the protected building. The operating philosophy behind COPTIR was to configure it so that it normally operates at a high immunity level, changing to become very sensitive to fires when any one fire characteristic (the presence of heat, CO or smoke) is present, but only signalling an alarm when all elements are present. In this way, transient nuisances are monitored and ignored, reducing the false alarm rate.

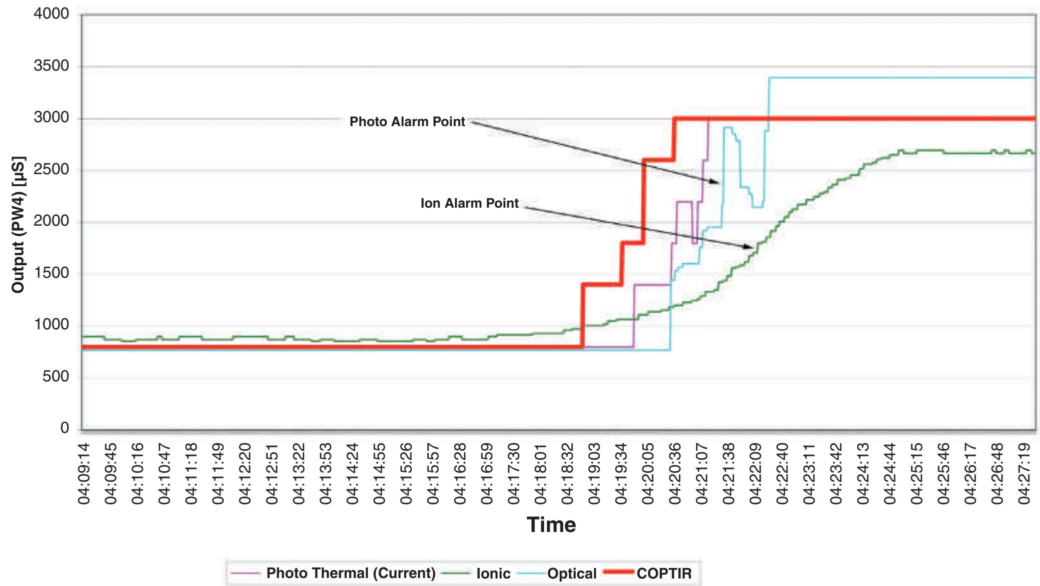
COPTIR is the first detector to use IR to monitor the environment. The infra-red sensing element is used as a light radiation sensor, with algorithms to give protection against false inputs, such as welding, that may affect the optical sensor. When the signature of the visible radiation from welding is predicated, the sensitivity of the photoelectric sensor is decreased to take account of the risk of false alarm. The IR detector is a daylight filtered photo-diode placed on top of the detector to give a 360° viewing angle, detecting IR radiation in the 800 – 1200 nm range. When it responds to a well defined flicker profile, usually caused by flames, the sensitivity of the other sensing elements are increased to improve the response.

COPTIR is managed by on-board intelligence running some very advanced algorithms, which dynamically adjust the detection profile of the device in response to the inputs from the sensors. This enables it to be re-characterised on the fly as the ambient conditions change. Based upon the sensor signals, the program is dynamically changing sensor thresholds, changing sensor gain, changing time delays, changing combination,



Beechwood sticks test

Cotton wick fire test



changing sampling rates, changing averaging rates and, if any sensor fails, changing sensitivity of the remaining sensors as well as indicating a fault condition. The IR light sensor helps the detector recognise specific false alarm situations such as welding and makes adjustments rapidly. The unique combination of different sensors and powerful DSP (Digital Signal Processing) results in COPTIR outperforming all detector types using alternative single or multi-sensor technology against which it has been tested.

Fire Test Results

As well as testing COPTIR against standard fires in the standard fire test room against the standard mandatory fire tests, a special small room was constructed within the fire test room to represent typical "real world" situations where detectors are actually installed. In a more confined area, toxic particles and gases can build up much faster than in a large fire test room so the fire needs to be detected as early as possible.

It is this "real world" performance that sets COPTIR apart from any other detector currently available. In a very extensive programme, COPTIR has been tested for 21 different false alarm tests and 29 different fire alarm tests, probably one of the most comprehensive series of tests ever run by any manufacturer during the development of a new device.

The false alarm tests included:

Nuisance – Water mist
Normal – Condensation plunge
Nuisance – Ramping aerosol in smoke box
Nuisance – Spray aerosol – small room
Nuisance – Propane buffing of floor – small room
Nuisance – Dust and fan small room
Nuisance – Disco fog – small room
Nuisance – Toast – dried white bread
Normal – Deep fat frying french fries
Nuisance – Water mist with fan on inside container
Nuisance – Oily toast in toaster oven
Nuisance – Oil coated pan – toaster oven

COPTIR did not return a false alarm in any of these tests: other single and multi-criteria detector technologies alarmed. The false alarm tests were chosen from the types of typical false alarm scenarios that a photoelectric detector would face in the field.

The detector was also subjected to a series of fire tests: the results showed that although the detector is highly insensitive to false fire alarms, this does not compromise its potential for fire detection; it also conclusively demonstrates that it provides the best performance available for detection of fires across the full spectrum of different fire types. The fire tests selected were biased to the flaming end of the scale, because it is known that these are less favourable to the photoelectric smoke detection technology, which is the primary sensor of the COPTIR. The performance of the COPTIR indicates clearly how well the integration of the four sensing elements works. While the ionisation detector is rightly reducing in popularity as the result of environmental concerns and legislative constraints, there is no denying that for detecting fast flaming fires, it is a better technology than photoelectric. The tests show that COPTIR can be used as an alternative to an ion detector without any reduction in performance.

Conclusions

The introduction of COPTIR sets new performance criteria for false alarm immunity and speed of detection. The Fire Service should see a reduction in the incidence of false alarms, and fire engineering companies can extended the coverage of the system into difficult-to-protect areas, where short-lived smoke-like phenomena are frequently produced. COPTIR gives greater functionality in system monitoring and control, enabling the system to be more closely tailored to the expected occupation patterns of the protected premises. End users will appreciate the reduction in false alarms that not only disrupt the working day, but have direct financial costs from empty buildings and lost productivity through to the fire brigade call-out fees. They will also protect themselves from the threat of the fire-brigade *not* immediately attending a real fire alarm from the automatic system if an excessive number of false alarms have been previously signalled. IFP

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www.systemsensoreurope.com

FFE introduces new generation of auto-aligning optical beam smoke detectors

FIRE FIGHTING ENTERPRISES LTD, one of the world's largest manufacturers of infrared optical beam smoke detectors, has launched the Fireray 5000, the first in a new family of products and accessories that have been designed 'from the ground up,' to fully address the needs of both the installer and the end user.

The product has a visible light laser which is aligned along the optical path of the infrared beam to assist the user in the correct placement of the reflective prism, ensuring the beam is not incorrectly aligned on another reflective object. When the beam is roughly aligned the *Autoptimise* function takes over, steering it into the optimum position.

If there is any deviation from the optimum performance position once the system has been installed, the Fireray 5000 will automatically compensate and, if necessary, re-align the beam, taking into account factors such as building shift. If required the user can also guide the beam manually using a four-way keypad located on the low level system controller. Automatic contamination control is also employed to preserve the set signal level and maintain a constant sensitivity to fire.

Wiring and installation are quick and easy due to separate first fix back boxes on both the detector and controller. The two wire interface between the detector and system controller also keeps installation costs to a minimum.

The Fireray 5000 has been designed to comply with all current and proposed standards, legislative and statutory requirements for this product type, for both domestic and foreign markets. All housing materials have a flammability rating of UL94 V0, and the product comes with a three year warranty as standard.

For more information please visit the company's website at www.ffeuk.com

Ian Steel appointed as FFE's new sales and marketing director

FIRE FIGHTING ENTERPRISES LTD, one of the world's largest manufacturers of infrared optical beam smoke detectors, has appointed Ian Steel as its new Sales and Marketing Director. Ian, who has been with the company since 2005, was promoted from his original role as Sales and Marketing Manager. He has been tasked with implementing the worldwide introduction of the Fireray 5000, the company's newest fire detection product.

With over fifteen years' experience in international sales, Ian has developed a vast knowledge of both the UK and overseas markets. Prior to joining Fire Fighting Enterprises he worked in a number of Sales Manager roles, most notably as International Sales Manager for Molecular Products Limited, where he held responsibility for sales of oxygen generating equipment for submarines and underground mining applications in the Far East region.

A chemistry graduate, Ian is married with two young children and is currently studying for an MBA with the Open University.

For more information please contact:
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BW Technologies by Honeywell introduces the revolutionary GasAlertMicroClip

– THE WORLD'S MOST COMPACT MULTI-SENSOR CONFINED SPACE GAS DETECTOR

The GasAlertMicroClip which is ATEX approved, offers full-function multi-gas instrument performance, with the simplicity, compact size and ease-of-use of a disposable gas detector. The small size, long life and high specificity of the sensors are central to the sleek, compact and functional design.

Simultaneously displaying oxygen, hydrogen sulfide, carbon monoxide and percent LEL combustibles present, the GasAlertMicroClip is ideally suited to a wide range of applications and customers including confined space entry, telecommunication vaults and manholes, refinery and petrochemical plants, construction contractors, and fire service and fire-ground overhaul monitoring applications.

The GasAlertMicroClip is housed in a rugged, fully immersible, water resistant housing with built-in concussion-proof boot. Other features include an extra-loud audible alarm, flashing LED light bars and built-in vibrating alarm. Field-selectable user options allow the GasAlertMicroClip to be customized for virtually any monitoring application.

The instrument is powered by means of an internally housed lithium polymer battery that provides up to 14-hours on continuous operation on a single charge. At just 160 grams (5.6 oz.), GasAlertMicroClip is truly more for less.

Simply put, the GasAlertMicroClip is the world's best value in confined space gas detectors.

For more information about GasAlertMicroClip, visit www.gasmonitors.com

Fulleon Limited

Building the future on sound success of the past

Fulleon Limited is Europe's leading manufacturer of life-saving, audible and visible alarm signalling devices which it supplies to many countries around the world, with nearly 30 years experience in design and manufacture. Well featured and intelligent product ranges provide customers with appropriate solutions for even the most testing of applications.

However, even though Fulleon sounders provide the reliability and consistency absolutely vital in life-threatening situations, they can also be put to work anywhere a distinctive warning is needed. Factory and plant processes, security, transport and many other applications operating in widely different circumstances can utilise Fulleon sounders.

Founded in 1978, the company originally manufactured only audible alarm sounders. Since then, it has evolved a wide range of related alarm system ancillaries through this expertise in their design and manufacture. Today, Fulleon manufactures products from traditional bells to state-of-the-art devices. The company's experience in electronic, mechanical and acoustic design has led to the development of a significant number of patented technologies that is incorporated into both standard and customised product designs. Sounders, beacons and callpoints are made in standard 'off-the-shelf' ranges that are both comprehensive and extensive. Nevertheless this does not preclude the company from also producing bespoke versions of all these products to meet individual customers' specific requirements in a number of safety-related markets, albeit that the fire-protection industry remains the company's core specialisation.

Currently, the fire industry is facing more legislative change, both in Europe and in the UK, than probably at any recent time. Fulleon's audible and visual alarm products have been developed to meet the requirements of European directives as well as UK national legislation. Fulleon fire products – such as the widely specified Roshni, Squashni and Symphoni sounders – are generally accepted as established benchmarks, setting the standard for competitive products to such an extent that the names are often used within the industry as generic terms.

Single site

As a manufacturer, Fulleon is unusual in having all its facilities based on a single site at a purpose-built factory at Cwmbran in South Wales. By having all research, design, development, engineering and manufacturing capabilities along with its customer service department at one centralised location, the company believes the resulting internal communication and strong cross-discipline collaboration leads to a more coherent approach in its operations. With the entire workforce and skills-base in one place, the company feels more able to respond quickly to changing market needs and to specific customer requirements. The site in South Wales certainly seems to be a major factor in Fulleon's continuing success.

Research & Development

The company is committed to developing all elements of the business by carefully analysing customer feedback in order to provide a service tailored to meet the technical and commercial demands of the markets that the company serves. This is ably demonstrated by Fulleon's ongoing commitment to its Research & Development programme. The company is continuing to develop and patent new technologies. Indeed, some 40% of Fulleon's current product sales comprises products that did not even exist six years ago. Its R&D team, which is split across four disciplines: software, electronic, mechanical, and process, has established a reputation for originality in design and product development. Over the course of many years, investment in the development process has brought about several product innovations. In the case of its new alarm sounders, Fulleon's experience dates back fifteen years – its Roshni, Squashni and Symphoni brands now being synonymous with excellence in sounder technology.

Latest Developments

The Roshni Low Profile (RoLP) is the fire alarm market's leading conventional sounder that also finds uses in much wider applications such as security or manufacturing. Its wide operating voltage and tone range make it very adaptable, even in its most basic form.

The first generation "Squashni" evolved from the Roshni ("Squashed Roshni") and is still recognisable today as a market-leading conventional platform sounder. It offers a range of alarm tones and is, most importantly, mechanically compatible with a large number of fire detectors. Its sister product, the Squashni Micro (SQM), offers low power operation with high output at the expense of some of the mechanical compatibility of the original. The success of the SQM is reflected in the number of addressable variants that has been developed from its basic format.

The introduction of LED-based beacons in the Solista range is also bringing about a new industry approach to visual alarm technology. Again, experience gained with the Solista beacon has been put to good use in the Squashni G3 range, the third generation of Squashni sounders and latest addition to the Fulleon family, along with latest generation LEDs and improved drive circuits.

Squashni G3 range

The Squashni G3 and G3AV have taken aspects of both original Squashni and SQM versions to produce a totally new type of platform sounder that has not only mechanical compatibility coupled with efficient performance, but also an integrated LED beacon because of the DDA (Disabilities Discrimination Act) requirements in the UK and the universal drive for lower installed costs. They constitute a family of products which is compatible with a number of system types including: standard conventional; LED triggered addressable; addressable; conventional versions with isolator; and variants for two-wire operation with detectors.

Sounder-only versions of the Squashni G3 are available in white and all standard colours to match leading detectors. The sounder and AV versions are clearly different and demonstrate a deliberate approach to differentiate between the two types of alarm. It would have been very easy and far more commercially effective to produce both in identical housings. But the risk of a sounder being mistaken for a beacon and therefore expected to emit a visible, flashing signal, was considered confusing and likely to cause reports of mistaken faults. The larger diameter of the Squashni G3 is also a deliberate consideration. Unlike many recent, platform-style sounders and beacons matched to specific detector diameters, the size of the Squashni G3 unit means that light from the beacon can be projected downwards as well as sideways giving a wide angle of view. This can be particularly useful where the unit is generally viewed from below such as in smaller spaces like bedrooms and cellular offices.

The Squashni G3 is also ideal as a compact, stand-alone unit. Its design is such that its audible performance is constant, the acoustic path having no reliance on the configuration of the unit, whether a detector is fitted or not. Where no detector is utilised in tandem with the unit, a cap can be fitted to give a simple, clean and unobtrusive finish.

Fulleon's Symphoni wall sounder has always been seen as a natural partner for the Squashni Micro, both having been conceived as ultra-low current sounders that could form the basis of addressable units for original equipment manufacturers (OEMs). The original model established the benchmark for efficient, high output wall sounders and the new Symphoni AV sounder again sets the standard with a completely revamped design. Basic performance has been enhanced with the addition of a new, purpose-designed LED beacon assembly, the horn is shorter to give a wider viewing angle to its centrally mounted beacon and the internal layout has also been changed. A much bigger area is allocated for the PCB and more room has been allowed for wiring in the field.

Not surprisingly, the Symphoni AV and its partner, Squashni G3 are similar in performance. Both draw 4mA for the sounder and 4mA for the beacon. The output for Symphoni AV is 100dB(A) and that for Squashni G3 is 90dB(A). Beacons in both again perform similarly but do so necessarily with a differing dispersion pattern. On axis the Symphoni AV produces more than 2Cd. By attending to the requirements of new legislation, taking into accounts the changes in fire protection practice, along with issues of installation and performance, both units represent a major advance in a number of areas but most importantly, in terms of improved efficiency and installation costs.

Customer Focus

Fulleon also places a high priority on customer service. In 2005, in response to a trend towards 'just-in-time' service, the company introduced Fulleon Xpress, a next-day despatch service for the standard range of sounders, beacons, bells, call-points and door-release units. It has developed a programme that ensures all areas of the business understands the needs of customers and, to monitor and improve the service it provides, the company sets a number of targets against which it can be measured in terms of productivity, sales efficiency, lead times, delivery and internal training. Performance of the Fulleon workforce is constantly appraised, thereby providing a very real stimulus to motivate further improvements and to establish the highest level of customer service.

Ongoing Development

In anticipation of legislative changes, Fulleon has also been implementing new procedures in its environmental programme. In order to protect employees, customers and the environment, the company is working to identify any materials used in its processes that could to be hazardous. Every Fulleon product covered by new legislation and its packaging is now therefore fully compliant with the WEEE and RoHS Directives.

But the very nature of product development means that it remains a continuously ongoing process. An important part of that process is recognising the shortcomings of products that have gone before – and ensuring that new products not only build on the successes of predecessors, but also deliver further real benefits. That is certainly true of the current generation of Fulleon products. Responding to changes in legislation, fire protection practice, installation issues and product performance over the last few years – and anticipating future changes – Fulleon has put much thought and investment into its latest range of products. No doubt those very products will also be the catalysts for future change. Fulleon is said to be already investigating future technologies with particular emphasis on intelligent, multi-functional product ranges. IFP

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Stratos Protects New Armed Forces Transporter

Seven Stratos-HSSD® (High Sensitivity Aspirating Smoke Detection) units and 1,500 metres of sampling pipework have been installed in a new wing assembly centre at Airbus UK, Filton, Bristol where work is under way on the new A400M military transporter, the aircraft, designed to meet the requirements of the airforces of Belgium, France, Germany, Italy, Luxembourg, Spain, Turkey and the United Kingdom.

The Stratos-HSSD units have been installed by MAT Fire Systems Limited of Bristol to protect the building that has been specially equipped to assemble the wings of the A400M.

Stratos, recognised as the most sensitive laser-based, aspirating system, and manufactured by AirSense Technology, provide reliable early warning inside the facility through ClassiFire®, a patented system of Perceptive Artificial Intelligence (PAI) which continually adjusts the detector to allow it to maintain a consistent level of performance, irrespective of environmental conditions.

Mr. Rick Coles, Managing Director of MAT Fire Systems, says: "With traditional aspirating systems, detectors are adjusted to a sensitivity set to a level just above the highest peak in the normal environmental smoke density. Thus, it is very easy to set such systems to be too sensitive, and thereby suffer from an unacceptable rate of nuisance alarms. With Stratos-HSSD, the ClassiFire® system adjusts the detector to match changes in the normal environmental smoke density. As the working environment inside the facility changes – because of dust or heat created in the manufacturing process – the system is able to adapt and so the amount of smoke needed to generate an alarm remains constant. With unmatched sensitivity potential, the system provides the very earliest warning of incipient fire.

The aircraft is a tactical transport, intended as a replacement for the ageing Hercules C130 which has seen many years of service supporting the armed forces in this country and overseas. The new aircrafts operational requirements include cargo and troop transport, material and paratrooper airdrop, maritime patrol, tactical operations, medical evacuation, ground refuelling, fire fighting, aerial spraying and humanitarian missions.

Aircraft final assembly will take place in Seville, Spain and the first aircraft is scheduled to take to the air in 2008.

For news purposes, facility photos available from Airbus UK Communication tel: 0117 9362746; A400M photos available from www.airbusmilitary.com

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Klaxon gets serious with new intense beacons

KLAXON SIGNALS has added to its Flashguard range of electronic sounders and beacons with the introduction of high intensity industrial xenon beacons. Designed for use in almost any industrial application, the beacons are available in a choice of voltages and colours.

Flashguard industrial xenon beacons are available in either 10J or 24J units that are designed for surface mounting. Both variants are high intensity beacons with Fresnel lenses that produce a penetrating light in the most adverse of conditions. Suitable for larger areas, they have single or double flash settings.

All units are weatherproof to IP65, and come with a choice of red, amber, blue, green and clear lenses. A range of accessories is available, including protective cage guards and wall brackets. A soft start unit is also available for the 24J beacon which operates on 24V DC.

The beacons can be used in a wide variety of applications, from alarm signalling to status indication to emergency and security warning.

For more information please visit the company's website at www.klaxonsignals.com

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Notifier's Onyx FirstVision™ Revolutionizes Emergency Scene Size-Up

Breakthrough Technology Helps Firefighters Quickly Identify Fire Origin and Migration, Building Hazards and Exit Routes

NOTIFIER, a world leading manufacturer of commercial fire alarm technology and systems announces ONYX FIRSTVISION', a revolutionary *wayfinding* navigational tool for firefighters and other emergency responders. With ONYX FIRSTVISION, Incident Commanders can focus on critical information necessary for making fast, effective and well-informed decisions, speeding scene size-up and execution of response operations. Only ONYX FIRSTVISION, a PC-based touch screen, graphically displays critical information on the origin and spread of a fire; allowing firefighters to quickly locate and extinguish the fire, reducing property loss and saving lives.

Using ONYX FIRSTVISION, emergency responders can immediately gather the information needed to accurately pinpoint the source of the fire and the rate at which it's spreading. In addition, ONYX FIRSTVISION is an interactive display summarizing building floor plans, with the location of all fire alarm devices, water supplies, evacuation routes, access routes, fire barriers, gas, power and HVAC shutoffs, as well as chemical and structural hazards in the building.

Developed from extensive research and interviews with senior level professional firefighters, ONYX FIRSTVISION is easy to use and requires no special training. Before ONYX InSight, a building's fire alarm control panels were the primary source of information for firefighters arriving on the scene. Typically, fire alarm control panels display activated alarms as a list in alphanumeric location code with limited descriptions. But with ONYX FIRSTVISION connected to the fire alarm control panels, crucial information is easy to interpret with a spatial, graphical depiction of the location and sequence of detector activation. And unlike traditional graphic annunicators, ONYX FIRSTVISION is interactive, allowing emergency responders to access information they need to conduct safe and efficient emergency response operations.

ONYX FIRSTVISION – another breakthrough technology from NOTIFIER. Leaders in Life. Safety. Technology.

For more information on NOTIFIER and its products, please call: + 1 (203) 484-7161 or visit their website at www.notifier.com

VESDA safeguards Underground Document Archive

Underground Archive Company use VESDA to Protect Invaluable Documents

150m below the ground, carved into the Winsford rock, is an innovative document archive owned by DeepStore, one of the UKís fastest growing offsite archive facilities. DeepStore uses the worked out sections of the mine for long term and 'active' storage, for which they provide a 24-hour retrieval and delivery service across the UK.

Selecting the right smoke detection solution was a priority and DeepStore chose VESDA not only for itís early warning capabilities but also as the installation was very flexible with simple sampling pipes suspended from stainless steel catenary/wire below the rough ceiling of the caverns.

Steve Holmes, Managing Director at DeepStore comments: 'Our customers expect the best possible protection of their documents, and that is exactly what we provide. For this reason it is of course tremendously important to detect any smoke at the earliest time in order to prevent damage. Additionally, VESDA affords us the extra time needed to investigate alarms prior to activating the extinguishing systems, which otherwise would be a costly affair'.

Helge Rognstad, EMEA marketing manager at Vision Fire & Security comments 'Owing to the unique nature of this storage facility, the VESDA smoke detection system is ideal because the sampling pipes can easily be installed where the smoke is most likely to go. Using VESDA detectors also means that it is easy for fire engineers to maintain the system at ground-level'.

For more information please contact: Vision Fire & Security Ltd Tel: + 44 (0) 14 4224 2330

Unapproved manual call points store up potential long term problems

Manual call points are an essential component of a fire detection system. KAC is the world's largest manufacturer, providing the global industry with UK-manufactured devices third party tested by LPCB, VdS, BOSEC and AFNOR. BS5839 part 1 2002 states that in order to achieve high reliability and reduce false alarms, the components of a fire detection and alarm system should have third party certification to the relevant product standard. The word "should" unfortunately allows the use of unapproved and untested call points, which are often promoted with meaningless statements such as "meets the requirements of", "designed in accordance with" or "conforms to" the relevant EN54 product standard, in this case EN54-11. No reputable fire engineer would consider using unapproved smoke or heat detectors, but call points sometimes seem to be regarded as less important elements of the system.

While untested and unapproved devices are normally sold at a discount, the overall saving on the product itself is generally small; the installed cost can actually be higher because the designs are not particularly conducive to rapid installation: small, difficult to wire terminals, limited space for cables and small securing screws appear to be the norm.

Third party testing by a reputable test house does far more than simply confirm the physical construction and operation of the device. Extensive tests for environmental factors such as operation at elevated temperatures, corrosion tests, EMC tests and shock and vibration are carried out, so a third party test certificate gives the installer and user confidence that the call point conforms in all respects to the requisite standard. To use non-approved devices is a false economy.

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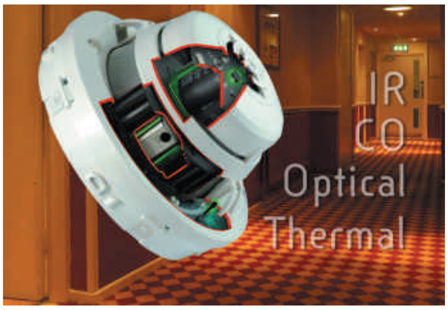
COPTIR: the world's most advanced fire detector



False alarms are a serious problem: in 2004, more than 280,000 false alarms were generated by automatic fire detection systems, causing disruption, unnecessary cost and wasting the Fire and Rescue Service's time. SYSTEM SENSOR has addressed the problem, developing an innovative solution based on advanced technology: the new COPTIR is the first multi-criteria fire detector to integrate four independent sensors into a single point fire detector. Extensive testing confirms that this latest development provides a step change in detection technology; it is the first detector specifically optimised to address the false alarm issue whilst also offering a major improvement in response times.

The detector consists of independent Carbon Monoxide, Photo, Thermal and Infra Red sensors, all managed by an embedded microprocessor running very sophisticated and responsive algorithms. Uniquely, the fourth detection element is a light sensor that provides environment monitoring to improve the false alarm performance of the device, and also improve response times to fast flaming fires whose detection has traditionally been a challenge to Photo and Photo Thermal smoke detectors. The integration of continual monitoring of all four major products of a fire has resulted in a detector that has ultra high immunity against false alarms whilst responding far more quickly to an actual fire. It is also highly configurable from the panel, allowing the detection system to be profiled to changes in the use and occupation of the protected building.

The culmination of a considerable investment in R & D, COPTIR has been extensively tested, not just under the standard EN54 test conditions, but for 21 different false alarm tests and 29 different fire alarm tests, probably one of the most comprehensive series of tests ever run when a new device has been developed. The test results show that COPTIR should make a significant contribution to the industry's efforts to lower false alarm rates.

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RJA establishes WFOE Office in Shanghai

ROLF JENSEN & ASSOCIATES, INC. (RJA) has established a Wholly Foreign Owned Enterprise (WFOE) in Shanghai, China. RJA previously maintained a presence in China through a Representative Office (RO). As a WFOE, RJA will provide professional fire protection consulting services directly to China-based clients as well as providing these services for US-based clients.

By establishing the WFOE, RJA is reinforcing its commitment to the clients and fire service in China. For over a decade, Martin Reiss, CEO, has spearheaded the effort to make RJA a recognized name in fire protection consulting in China. He, along with the RJA International team, has spent these years developing valuable personal and professional relationships with the fire service and officials in China. According to Mr. Reiss "the move to a WFOE strengthens our global presence and allows us to provide expanded services as a true China-based company."

The RJA Shanghai office will be managed by Fang Li, Vice President. She has been with the firm since 2001 and played an instrumental role in the growth of RJA in China. Ms. Li also serves as the Founding President of the China Chapter of the Society of Fire Protection Engineers (SFPE).

About Rolf Jensen & Associates, Inc.
Rolf Jensen & Associates is part of The RJA Group, Inc. We are a world leader in fire protection consulting including code analysis, fire/smoke/egress modeling, performance-based design and life safety construction management. Our sister company, Sako & Associates, provides value-added consulting services in security and media technology. Together, we can offer our clients seamlessly integrated solutions for all their fire protection and security challenges.

To learn more about Rolf Jensen & Associates, call toll-free 888-831-4RJA or visit our website at www.rjainc.com

RJA®

Ensuring a brighter tomorrow...

...calls for action today

The effects of fire on you, your clients, your business – indeed your entire world – can be devastating. So for peace of mind and a sunny future, you need to take action now, by specifying Hygood i3™ inert gas systems.

i3™ systems offers the protection of choice for high value assets, where a rapid and efficient response is vital. Effective against virtually all combustible material and flammable liquid fires, this low life cycle cost product comes with no risk of consequential damage.

With i3™ you're also demonstrating genuine environmental responsibility by doing something positive for the planet. Comprising argon and nitrogen, this agent has no impact of any kind on climate change or the ozone layer... so the sun will continue to rise on your world.

HYGOOD

For further information, please contact: Tyco Safety Products, Burlingham House, Hewett Road, Gapton Hall Industrial Estate, Great Yarmouth, Norfolk NR31 0NN.

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Blickling Hall.
Pic courtesy of Vision Systems Europe Limited

Performance Based Fire Protection: A Place in History

By Cheryl L. Domnitch, P.E.

and

Donald Hopkins, Jr., P.E

Hughes Associates, Inc., Baltimore, Maryland, USA

Meshing performance-based fire protection and historic preservation goals for the landmark Twohy Building in downtown San Jose, California, USA proved challenging, but achievable.

The Twohy Building rehabilitation project is an example of the challenges associated with finding ways for historical structures to become economically viable, but still conform to modern needs and expectations. The fire protection and life safety goals within historic structures can frequently be in conflict with the historic preservation goals. However, a successful project can be achieved by utilizing creative engineering concepts and including the building owner, designer and safety officials in the development of solutions.

Historic Preservation Goals

Constructed in 1917, the historic landmark Twohy building was originally designed by architect William Binder for Judge John W. Twohy as an office building. A majority of the building stood vacant for years, until the recent rehabilitation project that was a joint effort by the Redevelopment Agency of the City of San Jose and developer/owner the CIM Group. The five-story structure rehabilitation project included conversion of the office building to accommodate 36 loft-style apartments and a retail or restaurant with a plaza level frontage. The historic preservation goals included (1) retention of the interior hallways to continue the look and feel of the historic office space and (2) maintaining the open interior stairway which interconnects the five stories of the structure.

Building Description

The five-story building was originally constructed of non-combustible fire-resistive exterior walls. The interior of the building includes a mix of

Table 1. Project Goals

	Fire Safety	Historic Preservation
Goal	Provide an environment for occupants that is reasonably safe from fire and similar emergencies. Specifically, occupants that are not intimate with the initial fire development must be protected.	Develop fire safety design options that, to the extent possible, have a minimum impact on historic building features.
Objectives	**1:** Provide a fire safety design that will protect occupants who are not intimate with initial fire development for the time required to evacuate, relocate or defend in place. **2:** Provide a fire safety design that will maintain structural integrity for the time required to evacuate, relocate or defend in place occupants who are not intimate with the initial fire development.	Required life safety improvements should minimize the architectural or functional impact on historically significant areas.
Performance Criteria	**1:** Occupants who are not intimate with the initial fire development must not be exposed to instantaneous or cumulative untenable conditions. Occupants must be able to safely exit the building, relocate or defend in place without being exposed to untenable conditions. **2:** The structural integrity of building construction elements along the paths of egress and areas of refuge must be maintained during the time required to evacuate, relocate or defend in place.	To the extent possible, proposed life safety improvements should minimize the amount of architectural modifications to historically significant areas of the building.

combustible and non-combustible construction materials. The historic open stair is located at the west end of the building and discharges through a ground floor lobby. The renovation project included the construction of a new enclosed stair at the east end of the building. The new east stair is enclosed in two-hour fire-resistive construction with 90-minute opening protection and discharges to the exterior at the ground floor. The two stairs are connected by a hallway with studio apartments located on both sides of the hallway.

The historic office "storefonts" included non-rated glazing in the door assemblies as well as operable transoms above the door openings. As part of the historic preservation goals, a primary objective was to retain the glazing in the door assemblies and the transoms. The door assemblies were retained to serve as the apartment entrances.

Applicable Building Code and Fire Protection Features

The California State Historical Building Code (SHBC) was the applicable code for the project. However, the SHBC would have required either the enclosure of the open stair or blocking of the stair at each floor level. Both options were impractical and conflicting with the historic preservation goals of the project.

The renovation project included the retrofit installation of automatic sprinkler protection throughout the building and the installation of a fire detection and alarm system. The fire detection system included spot type system connected detectors within the common hallway and single-station smoke detection within the studio apartments. Both of these systems are a requirement of the SHBC for the occupancy.

The performance-based design approach (PBA) was based upon the National Fire Protection Association (NFPA), Life Safety Code (LSC), 2000 edition. The LSC establishes acceptable levels of risks to occupants of buildings based upon specified goals, objectives and performance criteria. The Twohy Building project included both a fire safety goal and an historic preservation goal, as shown in Table 1.

In order to assess the adequacy of proposed fire protection features, failure criteria were established and fire modeling was performed to determine if the fire safety and historic preservation goals could be achieved.

Conditions of Tenability

Initial analysis included the identification of scenarios that could result in an untenable environment for building occupants. The scenarios were defined as one or more of the following conditions:

1. Flames block the exit path,
2. The temperature of the fire gases makes all of the exit routes impassable,
3. Smoke from the fire limits visibility so as to prevent the people from moving to the exits, and
4. Toxic products from the fire cause incapacitation.

Conservative criteria were established in order to evaluate the building egress capabilities under severe fire simulations. A summary of the tenability criteria is presented in Table 2.

After occupants have been alerted to the fire emergency, there follows some time period that is available for egress activities prior to untenable conditions. During this time period occupants have the opportunity to evacuate the building at nominal exiting speeds. This period of time ends when conditions in the building deteriorate and present a hazard or significant impediment to any occupants still in the building.

Table 2. Tenability Criteria

Tenability Failure Mechanism	Criteria
Flames block exit path: Physical Impediment	Addressed through code requirements for multiple exits.
Temperature: Respiratory tract effects	Interface height of 1.83 m (6 ft) above finished floor and Minimum upper layer temperature of 100°C
Visibility: Degradation disorientates occupants and impedes egress	Interface height of 1.83 m (6 ft) above finished floor and Visibility reduced to 30 feet.
Toxic Hazard	CO concentration of 1,400 ppm

Design Fire Scenarios

A design fire scenario is a set of conditions that defines or describes the critical factors for evaluating a building or proposed design. Conditions include, but are not limited to:

1. the development, size and burning duration of the fire;
2. the location of the fire;
3. building characteristics (e.g., construction, ventilation, openings/connections between areas);
4. available fire protection systems (if any); and
5. occupant characteristics.

Design fire scenarios are challenging, but realistic, fire events intended to capture the type and severity of fires that could occur and challenge installed fire safety systems or responding personnel. Evaluation of the fire scenarios provides an estimation of the anticipated life safety hazard that could result from a fire.

The design fire scenarios were primarily based on anticipated fuel loading and building conditions for a residential occupancy. They also represented anticipated or plausible conditions that might arise, such as temporary storage conditions.

Based on the potential fire hazards, several design fires were developed. Design fires describe the key fire characteristics, but are independent of location, room geometry, installed fire protection systems, or occupant response. The design fires are coupled with specific locations and building features to create the design fire scenarios.

For a performance-based design, the Life Safety Code (LSC) requires the assessment of specific fire scenarios to determine the overall life safety capabilities of the building. Not all of the LSC specified scenarios were applicable for the Twohy Building. Working with the authority having jurisdiction, relative design fire scenarios were selected as follows.

1. *Typical occupancy-specific design fire scenario.* For a residential occupancy such as the Twohy Building a sofa fire in a second floor studio apartment was selected as an occupancy specific design fire. A sofa represents a large fire source for a residential occupancy and placement of the fire on the second floor exposes all occupants on the upper floors to fire products.
2. *Ultra-fast developing fire in the primary means of egress.* Fires in the second floor hallway and the fourth floor hallway were examined in this analysis.
3. *Fire in an unoccupied room near a high occupancy space.* A fire consisting of three bags of paper and plastic trash in the trash room adjacent to the second floor hallway was utilized for this scenario.
4. *Slow-developing shielded fire near a high occupancy space.* A sofa fire in a second floor apartment was utilized for this scenario. The heat release rate of the fire at sprinkler actuation was maintained for the duration of the simulation. This represents a conservative approach since no cooling or fire suppression effects were credited.
5. *Ordinary combustible fire with fire protection features independently disabled.* This scenario was addressed for the sofa fire in an apartment with sprinkler failure, smoke detector failure, and door closer failure with each protection system impairment independently analyzed.

Life Safety Evaluation

The life safety evaluation for the Twohy Building included three components:

1. Timed egress analysis,
2. Fire model application, and
3. Evaluation of fire effects

Timed Egress Analysis

An analysis of evacuation times from the Twohy Building was conducted to assess the conditions along the means of egress during evacuation, and to determine whether tenable conditions are maintained for the duration of egress. A timed egress analysis was performed for the Twohy building based on the egress components and occupant loads.

The time to evacuate a single floor and the entire building was examined for the Twohy building. Evacuation scenarios were considered in which both of the exit stairs were used, and in which the open exit stair was unavailable for egress.

The time to exit a given floor was calculated as the maximum time of the following:

1. Time to travel to the protected exit component or building exterior;
2. Time to wait in the queue for access to the protected exit component; or
3. Time to pass through the protected exit component or building exterior.

Additional time was factored into the calculated egress time as a safety factor based on a number of considerations such as the following:

1. Delays due to unfamiliarity of the location of exits (i.e., "way finding");
2. Delays caused by egress management activities (i.e., time for verification of alarms, announcements, etc.); or
3. Inefficient use of provided exits. Local concentration of exits may be high in some areas, while low (underused) in others.

The time for occupants to begin evacuation may also be influenced by their ability to know that a fire/alarm condition has occurred. Since the majority of the Twohy Building is residential, it is

Table 3. Summary of Results

Scenario	Description	Analysis Results
1	Sofa fire in second floor apartment with all fire protection features operable.	Evacuation successful
2a	Ultra fast fire in fourth floor hallway with all fire protection features operable.	Defend in place successful
2b	Ultra fast fire in second floor hallway with all fire protection features operable.	Defend in place successful
3	Trash room fire at second floor with all fire protection features operable.	Evacuation successful
4	Sofa fire in second floor apartment. Shielded from sprinklers.	Evacuation successful
5a	Sofa fire in second floor apartment. Failure of smoke detection system.	Evacuation successful
5b	Sofa fire in second floor apartment with transoms and window glass in apartment doors. Failure of automatic sprinklers.	Evacuation or defend in place not successful
5c	Sofa fire in second floor apartment. Transoms and window glass in doors provided with fire resistant glass. Failure of automatic sprinklers	Evacuation successful
5d	Sofa fire in second floor apartment. Failure of apartment door closer. successful	Defend in place

possible that occupants could be sleeping at the time of a fire. Therefore, it is also possible that the first indication of a fire for some occupants will be the sounding of the building fire alarm system. The design egress time begins from the time of activation of the fire alarm system.

Fire Model Application

Tools used in the evaluation of the design fire scenarios included the computer model CFAST. This model was used to determine the mass generation rate of smoke, average compartment temperatures, smoke layer depths, species concentrations and visibility in compartments near the fire. CFAST was also used to determine sprinkler and smoke detector activation and the impact of sprinkler protection on fire development (reduced heat release rate).

Evaluation of Design Fire Scenarios

The fire safety objective for the Twohy Building is to protect occupants who are not intimate with the fire for the duration of occupant evacuation or as long as necessary to defend in place. Performance criteria were used to quantitatively measure whether the life safety objective was met. In terms of maintaining tenable environmental conditions, visibility was primarily used as the performance criterion in this analysis since most fires produce sufficient smoke and products of combustion to result in visibility hazards prior to untenable conditions due to other parameters (e.g., temperature, and toxic gases).

The evaluation did not explicitly address the potential impact of manual intervention on fire development. Manual intervention could involve building occupants controlling the fire with fire extinguishers, or it could include the response of the fire department.

Times to exit each floor and the building were calculated. The egress times were compared with the time to hazard development to determine if occupants could safely exit the building, and or if they could defend in place. It was assumed that once occupants entered the rated exit enclosure, they could safely exit the building. This assumption maximizes the time for occupants to exit each floor, since they must all use the same exit. Egress through the open stair was only assumed to occur if access to the enclosed stair was blocked on the fire floor.

Discussion

The impact of various fire scenarios on occupant egress was examined through this PBA. For each fire scenario, the ability of occupants to defend in place or exit the building without being exposed to hazardous conditions was assessed. Table 3 shows a summary of the results for the various scenarios.

For all of the scenarios, with the exception of scenario 5b, occupants could safely exit the building or defend in place. The fire duration for all of the scenarios, with the exception of scenario 5b, was anticipated to be short in duration. The fires grow until actuation of the sprinkler system, at which time the heat release rate of the fire would begin to decay. In all of the cases where defend in place has been listed as a successful approach, the occupants are not exposed to incapacitating concentrations of toxic products of combustion nor are they exposed to hazardous temperatures. In these scenarios, if the occupants attempt to exit the building and visibility is obstructed within the hallway they can safely remain in their apartments.

Based on the timed egress analysis, the single enclosed stair provides adequate capacity for occupant egress. Specific instructions and signage were required to be provided to occupants informing them that the enclosed exit stair should be utilized in the event of a fire or similar emergency. The open stair does however have value for occupants on the fire floor as an alternate escape route if the fire blocks their access to the protected stair.

The analysis assumed that any products released into the building would remain permanently. However, upon fire department response, when the building is vented, visibility would return throughout the hallways.

The development of hazardous conditions within the apartment unit of fire origin was not considered in the analysis. Hazardous conditions could develop for the apartment unit of fire origin for any code compliant design. The same situation applies to the hallway of the fire floor. If the building was fully code compliant, a fire on the second floor could create a hazard or egress impediment within the second floor hallway. The occupants

Blickling Hall.
Pic courtesy of Vision Systems Europe Limited

would then be required to defend in place. Based on this, the concept of defend in place is considered a reasonable measure for short duration fires.

Scenario 5b presented a situation where safe occupant egress could not be guaranteed. Since the fire was not short in duration, defend in place was not considered a viable option for the scenario. As a result, the scenario was reanalyzed for the case where the glass transoms and glass within the apartment doors would remain intact long enough to allow safe occupant egress (Scenario 5c). The results indicated that if transom and door window glass protection is provided in a manner that will permit the glass to remain in place for approximately five minutes after flashover, the occupants could safely exit the building.

Protection for the door window glass included glazed panels tested for a 20-minute fire-protection rating. However, replacement of the existing historically significant frames would have resulted in a conflict with the historic preservation goals. Therefore, the frames were modified to retain a similar historical aesthetic, but an improved ability to maintain the 20-minute glazed panels in place. The frame modifications included increased return depths, increased caulking to hold glass in place, addition of an intumescent paint to frame moldings or frame moldings a minimum of ?-inch thick. The intent of the thickness of frame moldings is to ensure that charring of the wood frame within the occupant evacuation period will not weaken the frame resulting in the glazing falling out of the frame.

Protection for the transoms was achieved by providing a 20-minute fixed fire-rated glazed panel in parallel to the existing transom glazing on the apartment unit side. This allowed for the desired historical visual aesthetic of the transom from the hallway side.

Conclusion

The impact of the open historic stair at the second through fifth floors was examined through this performance-based assessment. The ability for occupants to safely exit the building or defend in place for a range of fire scenarios was assessed. Based on the analysis performed it was determined that occupants could safely exit the building or defend in place for all of the scenarios except one. The modeling also demonstrated the importance of properly designing, installing and maintaining the sprinkler system to maximize the likelihood of successful performance to minimize the possibility of sprinkler system failures as assumed in scenario 5b.

For the sofa fire in an apartment, with assumed failure of the sprinkler system, hazardous conditions could develop before occupants could safely exit the building. However, it was demonstrated in the analysis, if the transoms and windows on the doors adjacent to the historic hallways remain in place for approximately ten minutes under fire exposure, occupants can safely exit the building prior to the onset of hazardous and egress impeding conditions. Therefore, modifications to the existing plain glass historic transoms and windows on the door assemblies were provided.

The analysis was based on the enclosed exit stair serving as the primary means of occupant egress and the open historic stair serving as a secondary means of egress. The underlying assumption of the analysis was that if occupants observe substantial smoke within the open stair they will utilize the enclosed stair for egress activities. IFP

Cheryl Domnitch and **Don Hopkins** are senior engineers with Hughes Associates, Inc. Both have substantial experience in historic renovation projects addressing fire protection and life safety goals while maintaining the historic fabric and features of the buildings.

A Kidde Fire Protection FM-100 System protecting computer server and data rooms at CDMA, a mobile telecom operator of The Communication Authority of Thailand in Chiengmai in Northern Thailand.

Suppression Solutions

Clean agent systems are used extensively around the world to protect business-critical computer and telecoms rooms, and also precious artefacts in archives, museums and art galleries. They don't cause collateral damage to whatever they are protecting from fire because they don't leave behind any oily residues, particulates, water or corrosive materials.

By Lee James

Kidde Fire Protection

No single clean agent currently available is suitable for all applications, and so the unique properties of each agent must be carefully matched to each application. Factors that need to be considered are the physical dimensions of the risk; whether or not it is occupied by personnel; weight/space limitations for suppressant storage; fire fighting performance; environmental credentials; and of course the overall cost of the system.

Latest technology

The latest arrival on the fire suppression market is 3M™ Novec™ 1230 Fire Protection Fluid. It differs from conventional chemical agents in that it is stored as a liquid and, thanks to efficient nozzle technology, is discharged into the hazard zone as a colourless, non-conductive and non-corrosive gas. The agent does not disrupt the operation of electronic equipment even when in its liquid state. This has been graphically demonstrated by mobile

phones being shown to work even when fully immersed in the fluid!

The big advantage of Novec 1230 fluid is that it has negligible impact on the environment. Known chemically as a fluoroketone, its greatest appeal is with companies where environmental considerations are high on the corporate agenda. Its impressive "environmental footprint" credentials include a zero ODP, an GWP of just one and a remarkably low atmospheric lifetime of only 5 days. It satisfies not only today's environmental regulations, but also meets all of those in the foreseeable future.

Novec 1230 fluid puts fires out quickly by reaching its extinguishing concentration in 10 seconds or less. It works by absorbing heat from the fire rather than oxygen depletion. It has the highest heat capacity of any commercially available chemical agent, giving it the lowest extinguishing concentration of 4 to 6 percent.

Novec 1230 fluid is people-friendly too. It presents no risk to personnel in occupied spaces at normal design concentrations. The US EPA Significant New Alternatives Program (SNAP) has classified it as acceptable for use as a total flooding agent in occupied spaces. In fact, its low extinguishing concentration (4-6%) in combination with a high No Observable Adverse Effect Level (NOAEL) of 10 percent means that it provides a safety margin of nearly 100 percent. This is by far the largest safety margin of any clean fire suppression agent currently available.

Novec 1230 fluid systems are available in 42 and 25 bar versions. While 25 bar systems are the most cost-effective, 42 bar systems offer increased design flexibility for large or complex pipe runs.

Chemical gases

With hundreds of thousands of systems installed in over seventy countries world wide, the most widely used Halon replacement is a hydrofluorocarbon (HFC) called HFC-227ea.

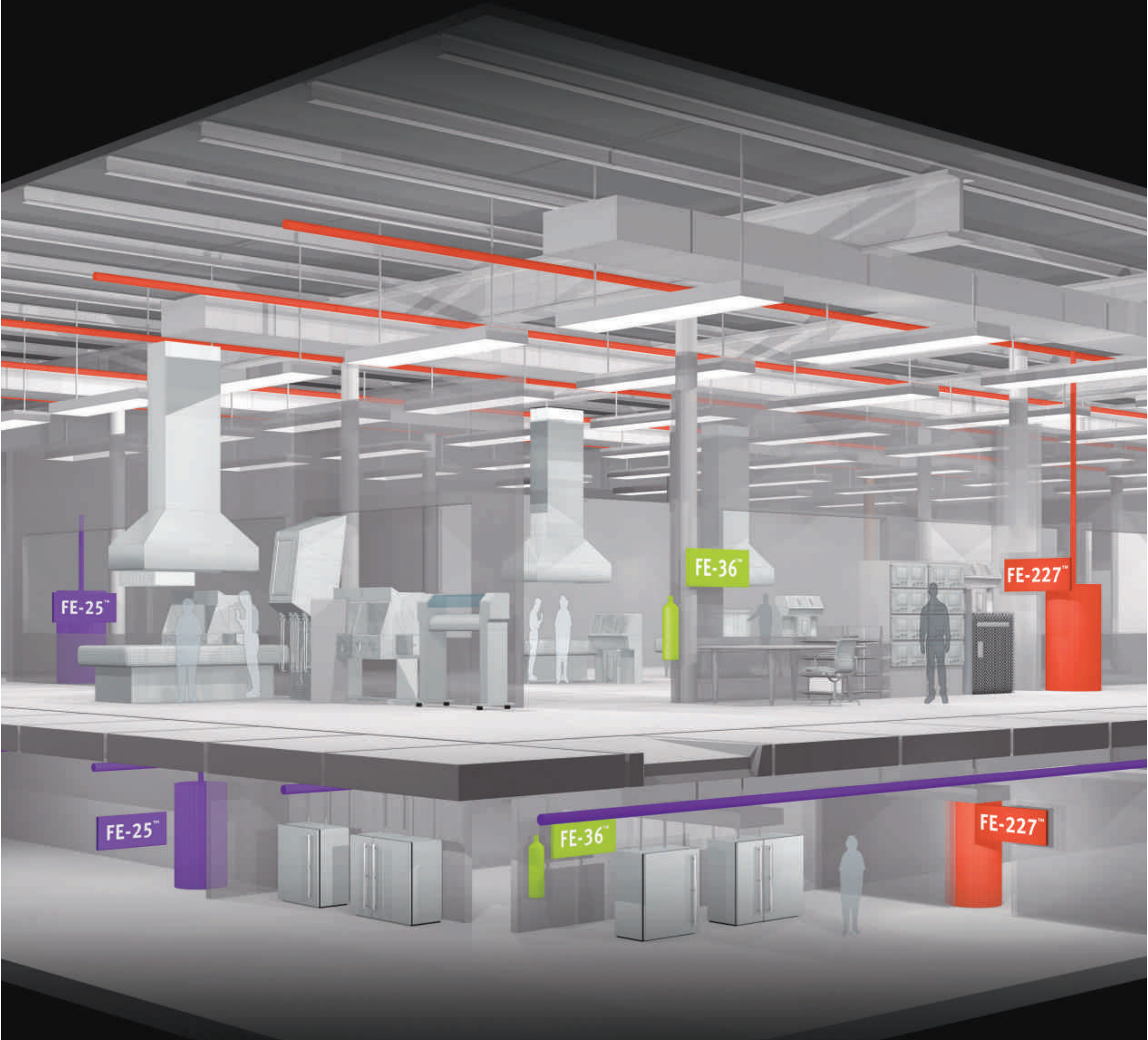
HFC-227ea works by absorbing heat from the flame and the fuel, reducing the temperature to a point were the flame can not sustain itself and the fire is extinguished. It provides rapid suppression, with a short discharge time of typically 6 to 10 seconds after fire detection. With a relatively small cylinder storage footprint HFC-227ea is ideally suited to use in areas were space is at a premium or weight restrictions apply.

The largest manufacturer of HFC-227ea is the US-based Great Lakes Chemical Corporation, recently re-named Chemtura. Known as FM-200™, its product is the most comprehensively tested clean agent in history. Over $20 million has been spent by Great Lakes on toxicology and safety testing. It is completely safe for use in occupied areas within prescribed concentrations and exposure times. It is so safe that it has even been designated as a replacement for CFCs as a propellant for pharmaceutical metred-dose inhalers (MDI).

HFC-227ea has a zero ODP, a low GWP and a short atmospheric lifetime of only 29 years. Since its environmental impact is negligible, it is likely to remain a viable agent for many years to come. Perhaps the best evidence for this is the fact that the US Environmental Protection Agency recently installed HFC-227ea systems to protect sensitive equipment at its National Computer Center in North Carolina.

Inert gases

These are a blend of gases that occur naturally in the atmosphere. Those most commonly used are argon, nitrogen and carbon dioxide. They are popular with organisations that prefer to use a non-chemical suppression agent. With zero ODP, zero GWP and zero atmospheric life time, inert gases have excellent environmental characteristics.


FE-25™
FE-36™
FE-227™
FE-25™
FE-36™
FE-227™

Pic courtesy of Kidde Fire Protection

Inert gas suppression systems, such as Kidde Argonite, work by displacing oxygen and reducing it from the normal 21% to a level that will not support combustion. A typical design concentration of 40% will reduce the oxygen level to 12.5% within 60 seconds. In occupied areas personnel can continue to breathe safely at this level for short periods of time.

The space requirement for inert gas storage cylinders is greater than that needed for chemical agents, although the latest systems with cylinder storage pressures of 300 bar offer significant space savings over equivalent 200 bar systems. The cylinders are mounted in rows and may be stored in any suitable location, even in excess of 100 metres away for the protected areas.

Carbon Dioxide

Carbon Dioxide (CO_2) was the original "clean" gaseous fire suppression agent pioneered by Kidde over eighty years ago. Since then it has safely extinguished more fires than any other gaseous agent.

CO_2 occurs naturally in the atmosphere and therefore has no restrictions on its use in fire fighting. It has a zero Ozone Depletion Potential (ODP) and a Global Warming Potential (GWP) of one.

CO_2 expands on release to form a combination of gas and fine particles of solid CO_2 or "dry ice". The gas penetrates the hazard area and extinguishes the fire primarily by reducing the oxygen concentration in the atmosphere to less than 15%. In addition, as the dry ice sublimes (changes to gas) it provides localised cooling. The dry ice particles also enable the extinguishing agent to be projected over much greater distances than would be possible with gas alone.

The versatility of applications is what gives CO_2 its true uniqueness. It has physical characteristics that allow it to be used to suppress fires in a wider variety of applications than any other gaseous agent. It is effective on a broad range of Class A, B and electrical fires. It can be used as a "total flooding" agent in enclosed spaces, or in "local application" for unenclosed equipment protection, or in a combination of both. Most other clean agents have only total flooding capabilities.

Another big advantage of CO_2 is that it is relatively inexpensive. This is because the cost of storage and distribution is spread over a wide range of industries, most notably beverage carbonation. This also means that CO_2 is readily available world wide for low-cost re-charge.

CO_2 occurs naturally in the atmosphere and therefore has no restrictions on its use in fire fighting. It has a zero Ozone Depletion Potential (ODP) and a Global Warming Potential (GWP) of one.

It is well known that CO_2 at fire extinguishing levels can cause death by asphyxiation to personnel who might inadvertently be in the hazard area. While it is widely used in unmanned applications, it is also acceptable for use in manned areas provided suitable safety measures are adopted. These are covered in NFPA 12, BS 5306 Part 4 and manufacturers' safety and operation manuals. CO_2 has a proven track-record of safety when these simple measures are taken. Over 100,000 systems installed world wide over the past fifty years show that it can be used safely.

Water mist

Even though it is not gaseous or classified as a clean agent, water mist is worthy of mention since it is increasingly being used in certain applications such as gas turbine enclosures. Water mist systems, such as Kidde AquaSafe, use the most natural of substances, deployed as a highly efficient fine mist made up of ultra-fine droplets in the range of 40 to 400 micron in diameter. They work by a combination of cooling and inerting and also have the added advantage over gaseous systems of removing airborne smoke particles and absorbing water-soluble toxic and irritant gases. It must however be remembered that water mist is not a total flooding agent and is transient in nature. It must be recognised that permanent extinguishing may not be attained if re-ignition sources are present.

Quality counts

Once the most appropriate agent has been selected for your particular risk, you are still only half way towards a solution. Whichever agent has been selected, the importance of ensuring that your system is properly designed, installed and maintained cannot be overstated. As a minimum you should make sure that system design has been carried out by factory trained and certified engineers. System components should be manufactured by a company registered to ISO 9001:2000 Quality Management System and comply with all relevant legislative requirements such as US DOT and EU Transportable Pressure Equipment Directive (TPED) for cylinders and Pressure Equipment Directive (PED) for pressure components. Systems should have independent third party approval to the latest international standards such as UL, FM Global, LPCB and VdS. Installations should be carried out by properly trained and certified engineers to ensure your system operates as intended, and maintenance should be carried out in accordance with manufacturers' instructions and relevant Codes such as NFPA 2001 and ISO 14520. IFP

Lee James has over twenty years in the fire protection industry, and in that time has built up a world wide reputation as an acknowledged expert on clean agent fire suppression systems with a background in design and installation. He is currently Product Manager at Kidde Fire Protection responsible for the global marketing of all the major suppression technologies including CO_2, FM-200™, Argonite™, and 3M™ Novec™ 1230 Fire Protection Fluid.

Evacuation Signs &

Pic courtesy of Jalite PLC

In recent years, many human lives have been lost in burning buildings due to lack of fire protection measures, overcrowding and mainly due to lack of proper evacuation planning. Such tragedies have put the evacuation planning and strategies in the spotlight.

By Sameh Dawoud

Consulting Engineer for Rolf Jensen & Associates, Inc.

While evacuation plans' main goal is to save lives during emergency situations, they vary depending on the facility itself and the nature of the emergency (fire, earthquake, flooding or bomb threats).

In the case of fire emergency, evacuation plans could be as simple as evacuating a facility with trained able adult occupants to a much more complex plans for evacuating airport terminals where thousands of people of different ages and mobility assemble with some of them for the first time to be in an airport terminal.

During fire emergency and following the sound of an alarm or if instructed so by the Public Address (PA) system, the occupants are required to immediately evacuate the facility using the nearest exit. Occupants should walk (and not run) to the nearest Exit or Exit-directional sign where evacuation signs will lead them to the proper path and exit discharge to outside the facility.

While evacuation plans have several requirements and components, some of the key elements of any evacuation plan are evacuation signs, evacuation routes (paths) and evacuation (emergency) lighting arrangements needed to light evacuation paths that guide facility occupants to exit discharge locations during power interruption, smoke filled and reduced visibility conditions.

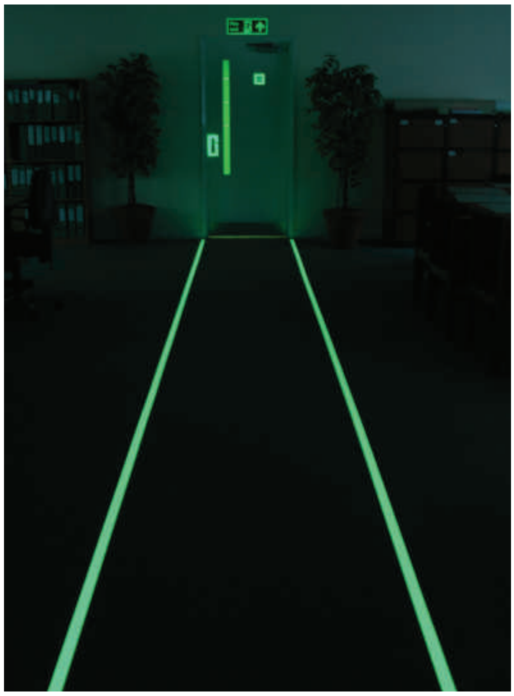
Evacuation signs: Evacuation signs inside the facility direct the occupants to nearest evacuation path, locations of evacuation maps (which include floor plans, emergency phone numbers and indicate locations of manual pull stations, portable fire extinguishers, first aid and emergency eyewash stations) and information on how to exit the facility safely. Signs along evacuation paths guide the occupants to the nearest exit discharge location. They should be readable at all times and should meet the following requirements:

- Written in easily understood (plain) language with minimum words and be appropriate for viewing distances.
- Use letter forms and color combinations that meet the requirements of applicable codes and with enough spacing provided between words.
- Letter height and illumination specifications (signs along the evacuation paths should be illuminated to a surface.

Value of 54 LUX minimum (LUX is a measure of light intensity with one candle producing 10 LUX at one foot Distance).

Evacuation signs could be written in different languages depending on the facility's use and occupancy.

Paths and Lighting



Pic courtesy of Jalite PLC

Evacuation paths: Evacuation paths are divided into primary and alternative paths and should meet the following requirements:

- Do not expose evacuating personnel to any additional hazards.
- Number of paths must be adequate based on number of occupants during peak occupancy.
- Paths should meet and height requirements and must be sufficient to accommodate maximum occupancy load.
- Should be made permanent as part of the facility layout.
- Should be separated from other normal activities areas of the facility with construction materials having proper fire resistance rating.
- Doors used to access evacuation paths should swing in the direction of travel.
- Openings not part of these paths to be marked "NOT AN EXIT".
- Paths must be free and unobstructed by locked doorways, furnishing or dead ends.
- Paths should have continuous wall and floor marking in corridors, stairs handrails and ramps with directional Arrows of photo illuminescent materials.
- Paths should be adequately lighted (or with emergency lights in case of power interruption) so that an occupant with normal vision can see along these paths.
- The line-of-sight to an exit sign must clearly be visible at all times along the evacuation paths.
- Only fire retardant materials are used in evacuation paths.
- Maps posted along evacuation paths should indicate evacuees location through "YOU ARE HERE" phrase along with direction to exit discharge and any other relevant information or instructions.

Evacuation Lighting: Evacuation (emergency) lights are required for corridors, stairs, aisles and passageways leading to an exit discharge. Power provided for emergency lights should be independent of the normal power supply of the facility and can be supplied either by batteries or other emergency source, such as diesel generator.

Emergency lights must automatically go into operation within 10 seconds of normal power interruption and must provide a minimum average illumination of 10 LUX (or 1 foot-candle) at any point along the evacuation paths.

There are different requirements for the duration of emergency lights based on the anticipated emergency and the specific requirements of the facility.

Conclusion: The success of safely evacuating occupants from any facility during fire emergency depends on the effectiveness of evacuation planning, the accuracy of evacuation plans and the coordinated efforts of facility management (in properly training occupants and maintenance and update of evacuation plans and features), personnel with different roles in the evacuation process, the emergency response team and the occupants' proper response in following evacuation instructions and signs. However, with increased threats (nature and man made) there is an urgent need for more coordinated effort, shared knowledge and experience on global basis in the area of evacuation planning and emergency response in order save lives worldwide.

As technology advances, it is conceivable that evacuation process for any facility can be monitored and directed from another specially equipped facility where evacuation administrators can have first hand knowledge

Of evacuation process status -through specially installed cameras and censors- in all evacuation paths and can direct and guide evacuating occupants to safe evacuation and the response team to where it is needed. IFP

Pic courtesy of Jalite PLC

Sameh Dawoud is a Consulting Engineer for Rolf Jensen & Associates, Inc., a leading fire protection and life safety consulting firm. He is based in the Los Angeles area office and can be reached by phone (714-257-3555) or Email (sdawoud@rjagroup.com)

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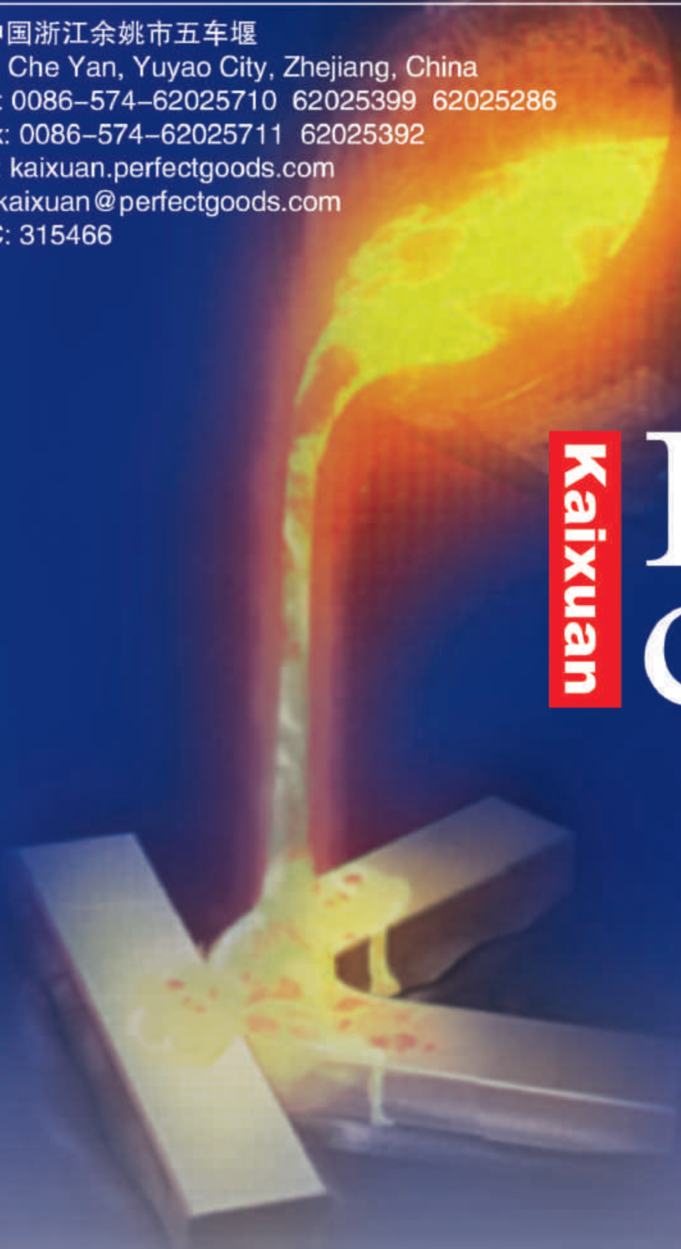


Kaixuan Fire control

Developments in modern fire extinguishers

At the beginning of the 20th century, in front of an audience in town centres, wooden structures were set alight. A salesman would then put out the fire using a fire extinguisher and sell them one from the back of the demonstration. Anybody who has witnessed fire testing of extinguishers could arrive at the conclusion that little has changed since. We still set fire to wooden cribs, not now as a demonstration to an audience, but to test the extinguishers ability to put out the fire as stated in EN3.

By Joseph Milton

Scheme Manager, LPCB

The first recognised extinguisher was invented in 1715. It was a wooden barrel that contained 20 litres of water along with gun powder and a fuse. It was thrown onto the fire and the explosion extinguished the fire.

The following highlights how extinguishers as we know them today have developed since 1715:

- 1816 saw the invention of a cart mounted copper vessel containing pearl ash liquid (potassium carbonate – still used in wet chemical extinguishers) which was discharged by compressed air.
- In the 1850s dry powder was introduced as an extinguishant.
- By 1866 the first soda-acid extinguisher was invented. Operation was by a chemical reaction producing carbon dioxide gas used to expel the contents.
- 1882, a patent was granted for the storage of liquid carbon dioxide in steel bottles.

- In the early 1900s the first carbon dioxide gas cartridge extinguisher with external cartridge was invented.
- In 1912, the carbon tetrachloride extinguisher was invented for use on petrol and fires involving live electricity. There were deaths from the use of this extinguisher in confined spaces because the vapour and combustion caused toxic by-products.

Since the introduction of fire extinguishers, they have evolved into two basic operating types: stored pressure and gas cartridge. A stored pressure extinguisher normally has a pressure gauge (except carbon dioxide), when the valve is opened the pressure forces the contents out of the extinguisher. A gas cartridge extinguisher, (which does not need a pressure gauge) is operated by piercing an internal gas cartridge which pressurises the extinguisher. The extinguisher then operates as a stored pressure extinguisher.

EN 3 is the European Standard for Portable fire extinguishers, currently there are three parts to this standard:

- Part 3 – Construction, resistance to pressure, mechanical tests.
- Part 6 – Provision for the conformity of portable fire extinguishers in accordance with EN 3 Parts 1 to 5.
- Part 7 – Characteristics, performance requirements and test methods.

Originally, in 1996 when this standard was published, there were six Parts. Part 7 was published in 2004 and supersedes Parts 1, 2, 4 and 5 (now withdrawn).

The following Parts of EN 3 are drafts and are currently in development:

- Part 8 (draft) Additional requirements to EN 3 for construction, resistance to pressure and mechanical tests for extinguishers with a maximum allowable pressure equal to or lower than 30 bar.
- Part 9 (draft) Additional requirements to EN 3 for pressure resistance of CO_2 extinguishers.
- Part 10 (draft) Provisions for evaluating the conformity of a portable fire extinguisher to EN 3 Part 7.

Fire extinguishers display the classes of fire for which they are suitable, the classes are letters A, B, C etc.

The classification of fires (BS EN 2) lists the classes of fire as below:

Class A: for use on flammable solid materials, such as wood, paper, coal, straw, cloth etc. Combustion normally involves the formation of glowing embers. The most successful method of extinguishing this type of fire is by cooling. For this reason a water extinguisher would normally be chosen for this risk. This type of fire can also be extinguished by smothering or starving the fire of oxygen. A foam or ABC powder extinguisher would be chosen for this reason.

Class B: for use on fires involving flammable liquids or liquefiable solids. Examples of flammable liquids are: petrol; methylated spirits; paraffin and paints. Examples of liquefiable solids are: grease; lard; margarine and shoe polish. This type of fire is extinguished by smothering and starving the fire of oxygen. A foam, dry powder or carbon dioxide extinguisher could be chosen for this type of risk.

Class C: for fires involving gases. Examples of flammable gases are propane, acetylene and butane. If there is a gas leak, the fire should be extinguished by closing the gas valve. It cannot be over emphasised that training is crucial when dealing with this type of fire. If for safety reasons the valve cannot be closed, dry powder BC and ABC is recommended for this type of fire. It is at the manufacturer's discretion to decide whether to mark an extinguisher as suitable for use on a Class C type fire. EN3 only permits powder extinguishers to be marked with a class C after they have achieved a B fire rating (BC powder) or A and B fire ratings (ABC powder).

Class D: for fires involving metals for example: magnesium; sodium; cadmium and manganese. These fires are usually extinguished by smothering. Specialist advice is needed to provide suitable extinguishers because these types of fires can be highly dangerous. These types of fires are extinguished by specialist dry powders extinguishers incorporating a low velocity applicator.

Class F: for use on cooking oil fires. Examples of cooking oils are: rapeseed; palm; vegetable; sunflower and olive. These fires are extinguished by cooling and smothering. The discharge cools the flames, whilst the formation of a foam blanket smothers the fire. Wet chemical (potassium salts) extinguishers are chosen for this risk.

LPCB has an extensive range of UKAS accredited fire testing facilities to conduct both Class A and Class B fires to EN 3.

Fire extinguishers display the classes of fire for which they are suitable, the classes are letters A, B, C etc.

It also offers fire testing and approval of Portable Fire Extinguishers to BS 7937 (portable fire extinguishers for use on cooking oil fires to Class F) and to BS 6165 (small aerosol fire extinguishers). The Marine Equipment Directive (MED), the Pressure Equipment Directive (PED) and the Transportable Pressure Equipment Directive (TPED) are Directives that are all applicable to fire extinguishers. BRE is also a Notified Body for all three of these Directives.

Approval, also known as certification is independent third party confirmation that products like fire extinguishers meet and continue to meet appropriate standards (ie. EN 3). Organisations such as LPCB which offer this service must be UKAS accredited for third party certification and testing of portable fire extinguishers. Approval is different from a test, as through regular audits it ensures that extinguishers continue to comply with the prevailing standards which can be subject to revision and replacement. The auditing process also helps to confirm that the extinguisher available on the market place is exactly the same as the extinguisher which was originally tested and approved.

Approval is beneficial to everyone in the supply chain from the manufacturer to the end user, because it gives peace of mind that the extinguisher meets the standard.

Globally specifiers are demanding third party approval. The LPCB mark is recognised worldwide and helps to confirm that products meet and continue to meet standards and specifications. For a full list of LPCB approved products please visit www.redbooklive.com IFP


Fire
is not always entertaining

Fire Alarm Co

Today's clients are demanding more from their Fire alarm system than ever before, and in many cases are no longer prepared to accept a "grey metal box" in their premises. In this article I shall not only attempt to cover the basic requirements of a Fire Alarm control panel, but also look at solutions available which will give the building owner a system they can be proud of.

By Phil Witts

Director, Rafiki Protection Limited

The control panel is the heart of every system and varies in complexity from a basic system that is little more than a junction box with some LED indicators to a very powerful micro-processor based system.

Regardless of the complexity, some basic requirements should be remembered:

1 In the event of a fire, the panel should indicate where the fire is located either by zone (usually an LED) or by the address (usually a LCD display clearly identifying the location of the fire, and an LED indicating the zone). This indication should be obvious to someone who has never seen the panel before.

2 The user controls should be clearly identified and "user friendly". Very often the person standing in front of the panel trying to silence the system due to a fault/nuisance alarm is not a qualified Fire Alarm engineer. This person should be able to navigate the basic functions without becoming confused due to the number of buttons, flashing LEDs and messages they could be faced with.

3 The panel should be capable of performing basic functions in addition to sounding the fire alarm sounders. Some of the basic functions could be: calling the fire brigade, opening smoke vents, closing fire doors and possibly shutting off gas supplies to the building.

4 The panel or panels should be capable of running the number of devices required for correct coverage of the building, with the minimum amount of cabling.

5 The panel should be easy to install, program and maintain.

Manufacturers now achieve these basic requirements and also design additional features, which give the client extra benefits, into their panels. These should hopefully make the system even safer and easier to use. Examples of such features could be remote diagnostics, printers and graphical displays.

ntrol Panels

What today's customer is now finding hard to accept is that even with all of the advances in technology that are available, the majority of Fire Alarm control panels are still rectangular grey or beige metal boxes.

Architects are employed to design "cutting edge" interiors and "forward thinking" reception areas, only to be faced with the prospect of putting a sheet steel enclosure proudly on display just inside the main entrance doors of the building.

Surely this can no longer be acceptable?

We expect/demand aesthetically pleasing products in our homes, even down to the design of the vacuum cleaner, so why should the owner of a new commercial property be prepared to accept a 1970s' designed enclosure?

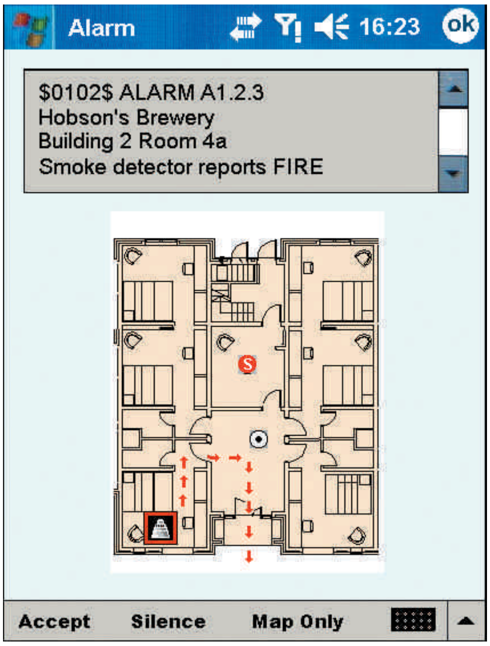
Fortunately today's more forward thinking manufacturers have not only dealt with the functionality and technical aspects of the product, but have designed fire alarm panels that would complement any of today's new buildings. This equipment can now be proudly displayed alongside the latest hi-fi/plasma televisions and give the client a product to reflect their business image. These award-winning product designs also give the installer/consultant/architect a product they would feel proud to associate their names with.

It is now possible not only to have an aesthetically pleasing fire alarm control panel, but also a fire alarm system that can be controlled from a PC with a graphical touch screen display. Taking advantage of the power of modern PCs, a central management system can be provided to extract the essential data from the fire panel and display it with simple to understand graphic maps (site layouts) with icons flashing in designated colours to indicate the state, position and other attributes (such as how much smoke is being detected). It is also possible to control the fire panels using "Virtual Panel Controls" and even to disable/enable devices, silence, mute, reset and evacuate from the central system.

A key benefit of the PC approach is that the central system could be customised very easily to provide a user interface to suit the abilities and requirements of the end user. 100% site configurability is a key facility and can easily be achieved with a properly designed PC based system.

Manufacturers who have taken the step to provide not just a graphics unit but an Alarm Management system can also provide features such as self-training for operators, full event logging with date and time of all fire events as well as operator actions, full analysis and even diagnostic reports such as "during the last 5 years the chosen smoke detector had provided 50 faults and every time a fault appears there was a coincidence of another event . . ."

The really forward thinking manufacturers have enabled their PCs to connect to all fire panels irrespective of the manufacturer. For example, in a university campus, it is not uncommon to see 20 different manufacturers' panels. The sophisticated



PC-based system can link to them all and provide a common central management system. This integration can even be extended to include other building critical alarms, plant alarms etc.

These systems can also have powerful connectivity to connect the various panels through a variety of connection media including twisted pair cables, fibre optics, client LANs, radio, telephone modems etc.

Once the PC system has processed all the information, in order to inform all relevant parties for necessary action (with the fastest response times), standard mobile phone PDAs could replicate the layout maps and flashing icons and could even give full information as to what action needs to be taken by the recipient (ie. Fire Officer, Health & Safety Officer etc).

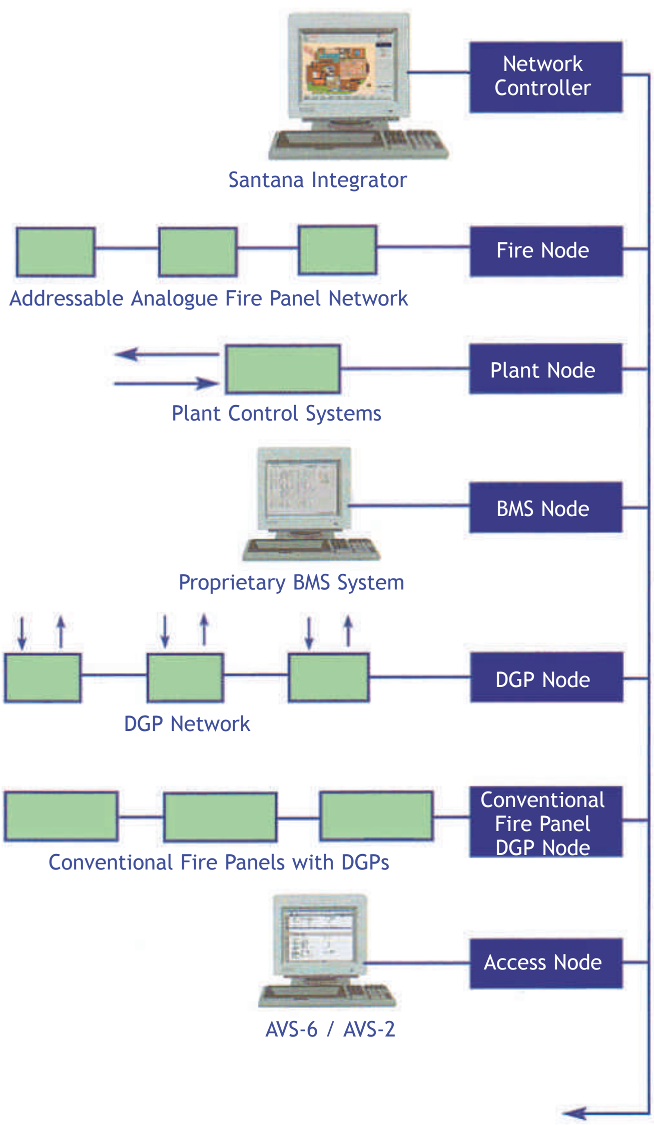
In a nutshell, it is reassuring to see that manufacturers are beginning to meet the need to provide solutions that empower the end-user client to be in complete control, while making it easy to operate, flexible to upgrade and all the time providing an extremely reliable solution, consistent with the requirements of a system that protects lives and buildings. IFP

Santana Integrator

The Integrated Building Protection System

Santana Integrator is a highly sophisticated and flexible, yet easy to use, PC-based Alarm and Event Management system for total integration of building protection systems.

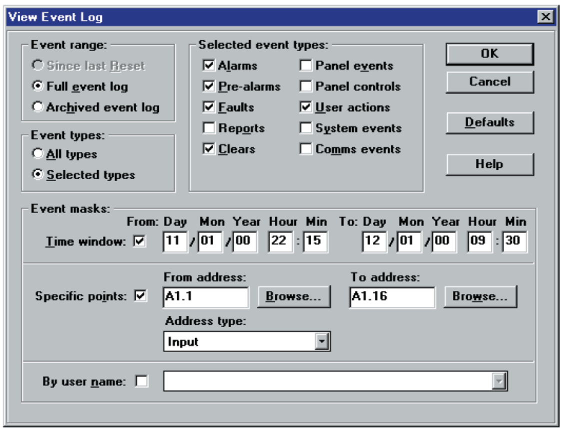
Its unique feature is its ability to integrate both existing and new equipment irrespective of manufacturer. This is made possible by the use of standard "Translator" units which can already work with most reputable proprietary panels in the Fire, Security, CCTV and BMS fields.



Features:

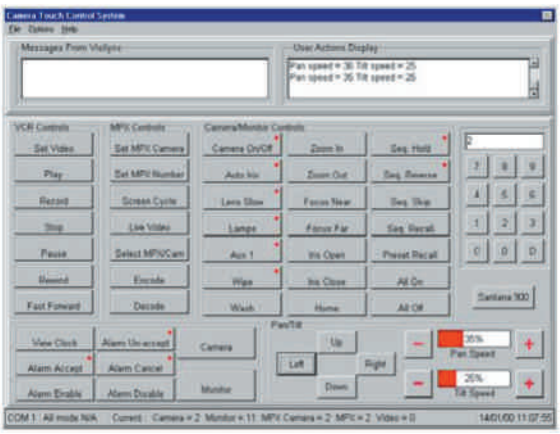
- Simple Graphical User Interface designed to work with Touch Screen (or keyboard/mouse).
- All maps and instructions can be presented on one split-screen page.
- Monitoring and control by icon-based interaction.
- Full colour drawings and photographs originating from almost any Windows drawing package can be imported.
- Electronic mimic/repeater built-in.
- Virtual Panel control feature.
- Password access to suit individual operators.
- 26 different disciplines may be integrated.
- 260,000 points can be accommodated.
- Totally field-programmable.
- Configuration and system manual printing feature built-in.
- Interfaces to Access Control AVS-6/ AVS-2.
- Optical isolation between subsystems.
- Full timezone control.
- Operator self-training and assessment built-in.
- Full Historic Analysis and Report Generation.
- Regular updates and enhancements.
- Windows 9x / 2000 / XP compliant, written in C++ language.
- Over 10 years development and credibility of reference sites.

All maps and instructions can be presented on one split-screen page.



Full historic logging and efficient analysis provide information quickly to operators and service personnel.

Sophisticated map facilities and flashing alarm sensors pinpoint problem areas and spread of fire.



Optional CCTV Control screen.

Many hundreds of user-defined maps/operator instruction pages are available for added information when alarms occur.

In pursuance of our policy of continuous improvement, we reserve the right to amend any part of the specification without notice.

Ref : SL9/8

Benefits:

- A fully PC-based system running under Windows 9x, 2000 Pro or XP provides an industry standard product with ease of maintenance/service.
- Built-in flexibility enables cost-effective solutions for all applications from small premises to large sites.
- Standard interfaces enable proprietary equipment to work directly with the alarm management system.
- Sophisticated map facilities and flashing alarm sensors pinpoint problem areas and spread of fire.
- The zoom-in map feature relates alarm area to access routes and quickly identifies areas in danger.
- Full historic logging and efficient analysis provide information quickly to operators and service personnel.
- "Log Only" feature is available for discreet security or fault monitoring.
- The system is 100% field programmable by the user.
- Direct digital control of outputs is available through automatic response to timezones, alarms and manual override.
- Multiple-level password control maintains system security and integrity.
- All password-protected operator events are logged with the operator's name.
- Priority levels may be allocated to events so that the most urgent can be dealt with first.
- All inputs may be isolated and reconnected, either manually or automatically by timezone.
- Up to 260,000 inputs can be handled, each with a unique single line user-defined message and up to 4 high resolution maps.
- On-screen menus always show exactly which steps to take next.
- The diagnostics facility enables alarms, faults, pre-alarms, and all historic records to be analysed, producing reports.
- Easy configuration utilises simple menu-driven program with mouse control.
- Alarms can be selected to be latched, unlatched or "re-triggerable" in configuration to suit individual monitoring requirements.
- Many hundreds of user-defined maps/operator instruction pages are available for added information when alarms occur.
- Maps can be imported from CAD or a number of standard Windows graphics formats.
- Optional CCTV Control screen.
- Line-listen network to provide additional monitoring stations.
- All systems are fully expandable, thus protecting the investment.
- Full commitment to continued development ensures software updates to enhance performance and facilities.

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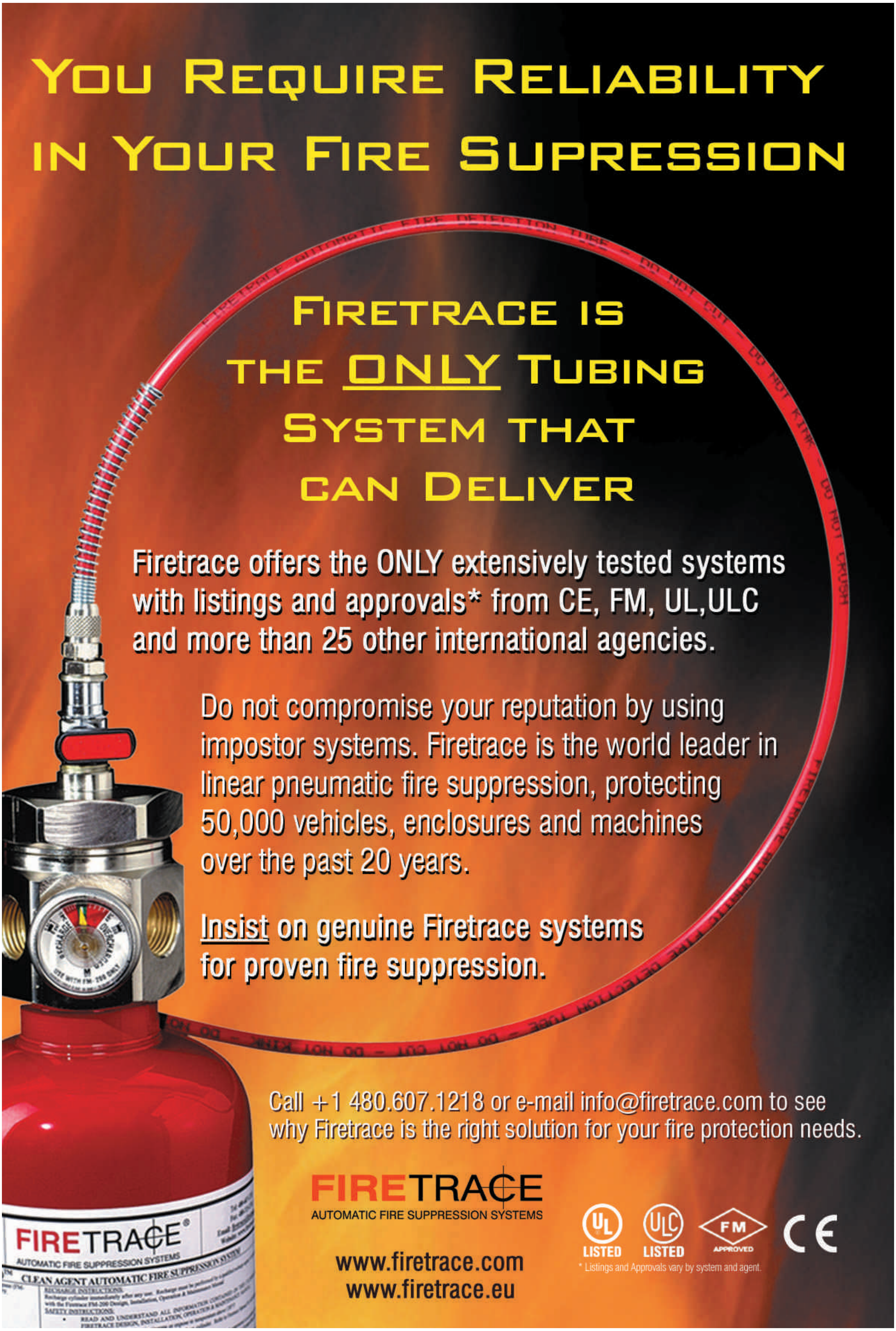
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Gas detection refined

Whether processing natural gas or petrochemicals, a number of different intermediate and end products are created that can be toxic or combustible. To avoid serious risks to health, environmental pollution or even an explosion, refineries need to be carefully monitored for any emissions.

By Ian White

Draeger Safety UK Ltd

When planning a new gas detection installation or considering making changes to an existing system, there are a number of questions that need to be answered. Only then can the correct system be specified. Some systems are designed to eliminate the risks to health in areas where toxic substances may be found whilst others are used to detect combustible gas leaks and prevent fire and explosions.

For example, both natural gas and crude oil contain sulphur compounds and nitrogen which, during processing, can lead to the emission of sulphur dioxide, hydrogen sulphide, mercaptans and nitrogen dioxide. In such applications, where a known hazard exists on a permanent basis, fixed gas detection systems can be used to provide continuous monitoring or, in the event of an emergency, to shut down all potential ignition sources. However, refineries also need regular maintenance, which can necessitate part or the whole of the plant to be shut down.

During repair or maintenance, workers may be required to enter poorly ventilated confined spaces such as tanks or pipelines. In this instance and to ensure their safety, portable gas detection equipment should be used to check for the presence of oxygen, hydrogen sulphide and carbon monoxide, as well as flammable gases, before entry.

The area to be monitored, the type of sensor, the control methods and ongoing maintenance requirements will all have a bearing on which is the right system for the particular application. The following questions should be asked before selecting the most appropriate gas detection equipment.

What is the purpose of the monitoring?

Is it purely a safety measure or are there other reasons? What alarm thresholds are appropriate and how will the alarm information be processed? When working with potentially explosive gases, for instance, a gas detection system can be designed to trigger a countermeasure as soon as a predetermined gas concentration level has been reached. If this measure proves to be inadequate and the gas concentration continues to rise, then a second alarm threshold will be crossed and all potential ignition sources can be automatically switched off.

Where, how often, and in what concentrations and quantities are the hazards likely to be released?

A workplace risk assessment will have shown which areas and which processes require continuous monitoring and which applications may pose a

threat to workers during cleaning or maintenance operations. The results of this workplace assessment will determine which portable gas detection instruments are the most appropriate and where fixed gas detection systems need to be employed.

Which sensor is the most appropriate?

Different sensors can be used in different applications. Broadly speaking, electrochemical sensors are used to detect lower concentrations of toxic gases, whereas catalytic or infrared (IR) sensors are used to monitor combustible substances in concentrations below the LEL.

Which type of portable instrument is the most appropriate?

There are a number of options and the workplace assessment will usually indicate which of the portable methods is the most suitable. As an overview, the following instruments all provide an immediate visual result:

- Short Term Tubes provide on the spot gas measurement and are suitable for monitoring personal exposure, spot check measurements, leak checks and confined space investigation. Ideal for use as part of the risk assessment process, the Draeger-Tube range, for example, enables fast, accurate measurement of over 500 different types of gases and vapours and can be used with the Draeger Chip Measurement System, a portable, multi gas detection system that requires minimal user training and which provides an immediate, true digital read-out without the need for further evaluation. Short Term Pumps (hand bellows) are also used in conjunction with the tubes and enable rapid measurements to be taken whilst providing optimum volume and flow specifications. Incorporating automatic stroke counters and a clear end of stroke indicator, pumps require no special tools and give accurate and reproducible results.

- Personal Single Gas Monitors:
  A wide variety of Personal, Single Gas Monitors are now available to monitor a broad range of gases including carbon monoxide, hydrogen sulphide or oxygen. Some of these, such as the Draeger Pac 7000, also incorporate a data event logger so that, as well as being assured of constant personal monitoring, the user can also record the results.
  Selection tips:
  For optimal use, when selecting these type of monitors ensure that the sensors have a short reaction time and find out how often maintenance is required. The latest electrochemical sensors respond immediately to any gas hazard and can offer completely maintenance free operation for two years. Also, check which alarms are incorporated. The better units will combine vibrational with visual and two-tone audible alarms, which are activated as soon as the threshold levels are reached. Finally, are they easy to use? Exactly how easy is configuration, calibration and downloading of the data event logger? These functions can all be easily and quickly carried out via an infra-red interface. If records need to be kept, this is an important feature.
- Portable Multi-Gas Detectors:
  Able to measure a number of gases simultaneously, these high performance instruments should be lightweight and easy to use. Available with individually adjustable visual and acoustic alarms, the Draeger X-am 2000 is a prime example in that it is ergonomically designed, lightweight and compact and offers reliable measurement of combustible gases and vapours as well as oxygen, carbon monoxide and hydrogen sulphide.
  With a low cost of ownership and dust and water-resistant to IP67, this rugged instrument remains fully functional and ready for use even after being dropped in water. The integrated rubber protection and shockproof sensors of the X-am 2000 also provide additional resistance to impact and vibration and the unit is also able to withstand electromagnetic interference.
  Selection tips:
  For maximum portability these units should be small in size and easy to carry. As a result, however, they are often accidentally placed in a jacket pocket – but do they still work when used like this? Units such as the X-am 2000 have gas inlets on both the top and front to ensure that, even if this were the case, it will still provide a reliable warning against gas

ST-5022-2005
You shouldn't have to settle for less.
Dräger Pac 3000 and Dräger Pac 5000 offer you maximum functionality. The robust, light-weight detectors monitor the ambient air for harmful concentrations of carbon monoxide, hydrogen sulphide, or oxygen reliably and give you two years of use maintenance-free.
Equipped with a large and easy to read display and crocodile clip, these single gas instruments feature our new XXS sensors. These extremely small sensors measure rapidly to ensure a fast warning.
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hazards. Also, does the compact design mean that the performance is affected? Some units can be as small as a mobile phone. By using the latest, miniaturised sensors such as the XXS generation from Draeger, gas detectors can retain their powerful functionality and still incorporate two-button control panels, a large liquid crystal display and easy menu guidance. Explosive hazards are also likely to be a problem in refinery applications. For improved safety when facing unknown hazards, some units incorporate a catalytic Ex sensor which, when calibrated to methane, responds quickly to explosive gases and gives an immediate warning to the user.

If a fixed gas detection system is required, how many sensors are needed and where and how should sensors be positioned and calibrated?

It makes sense that sensors and sampling points should be positioned so that gas accumulations are detected before they create a significant hazard. To ensure maximum performance, different sensor positioning strategies can be implemented to suit different workplace environments. Whilst these can, of course, be combined or modified, they are generally used to provide spot, area or perimeter monitoring.

Spot monitoring is used where the potential source of the leak is known and the sensors can be positioned to ensure that leaks are detected

quickly. Area monitoring requires an increased number of sensors to cover an entire area and is generally used where the source of the leak is not known. Perimeter monitoring is used in applications where the outer limits of the installation need to be checked and where it is important that potential hazardous gases do not reach neighbouring areas.

European Standard BSEN 50073:2000 lists a number of factors that should be taken into account when determining suitable locations. These include the location, i.e. indoor or outdoor site, potential sources such as the location and nature of the potential vapour/gas sources (pressure volume and/or mass, source temperature, density and distances), as well as the chemical and physical data of the potential gases/vapours present.

Other factors include leak control, the nature and concentrations of possible gas releases, the presence of cavities and jets and the general topography of the site. Air movements should also be taken into consideration as well as temperature effects, the local environment of the plant, the location and number of personnel in the plant and the location of potential sources of ignition. Any structural arrangements such as walls, troughs or partitions, which could allow gas to accumulate, should also be considered.

Used extensively in the North Sea, the Draeger Polytron can also be found in the Middle East, North and South America, Asia, West Africa and the former Soviet Union.

Perhaps most importantly, the Standard also states that the placement of the sensors and sampling points should be determined following the advice of experts having specialist knowledge of gas dispersion, experts with a knowledge of the process plant system and equipment involved, and safety and engineering personnel. It also advises that the agreement reached on the locations of sensors and sampling points should be recorded.

Used extensively in the North Sea, the Draeger Polytron can also be found in the Middle East, North and South America, Asia, West Africa and the former Soviet Union. Amongst other keynote users, Shell UK Oil Products has recently entered into a 3-year agreement with Draeger for the supply of fixed gas monitors for use at the Stanlow Manufacturing Complex.

Covering the Polytron 1, 2 and Infra Red range of toxic/flammable detectors and Regard controllers, as well as the new generation Polytron 7000 systems, the agreement formalises the long, successful relationship between the two companies.

With a team of specialist technical personnel, Draeger Safety Gas Detection Systems provides a comprehensive support service from initial advice right through to design, supply, installation, commissioning and ongoing maintenance for both sensors and fixed gas detection systems. IFP

Further information is available from:
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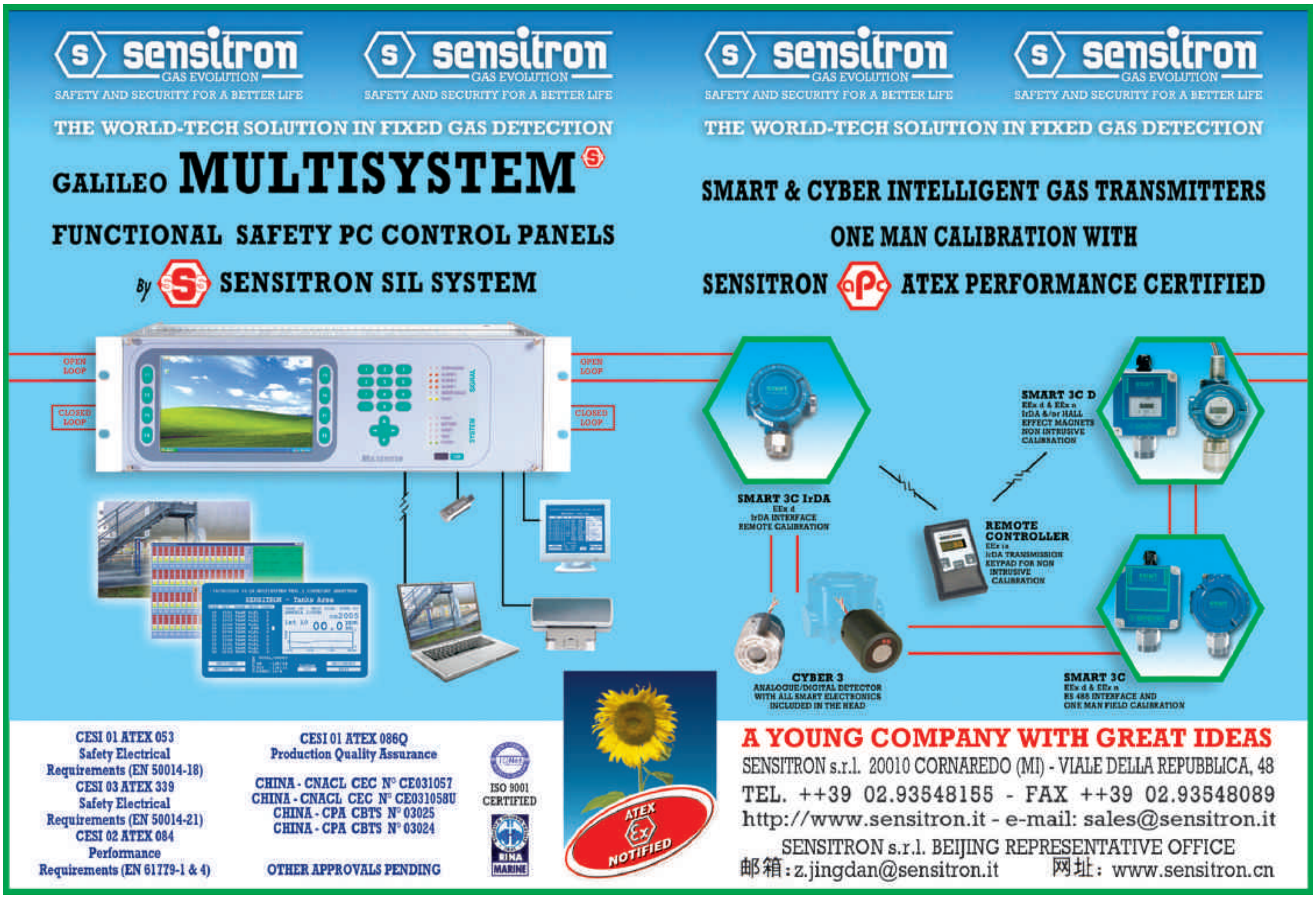
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VESDA Aspirating Smoke Detection protecting The Trafford Shopping Centre in Manchester

Predicting the Unpredictable?

This article is simply about best practice in Aspirating Smoke Detection (ASD) in the context of Performance Based Design (PBD). That may sound boring, pompous or even provocative but read on to learn how pioneering work in the modelling of incipient fires using Computational Fluid Dynamics (CFD) is helping to shape the future. Get to the end, and you will understand how current research is extending the use of ASD to achieve best practice smoke detection beyond the boundaries set by prescriptive standards.

By Peter Massingberd-Mundy

of Vision Fire & Security
www.vesda.com

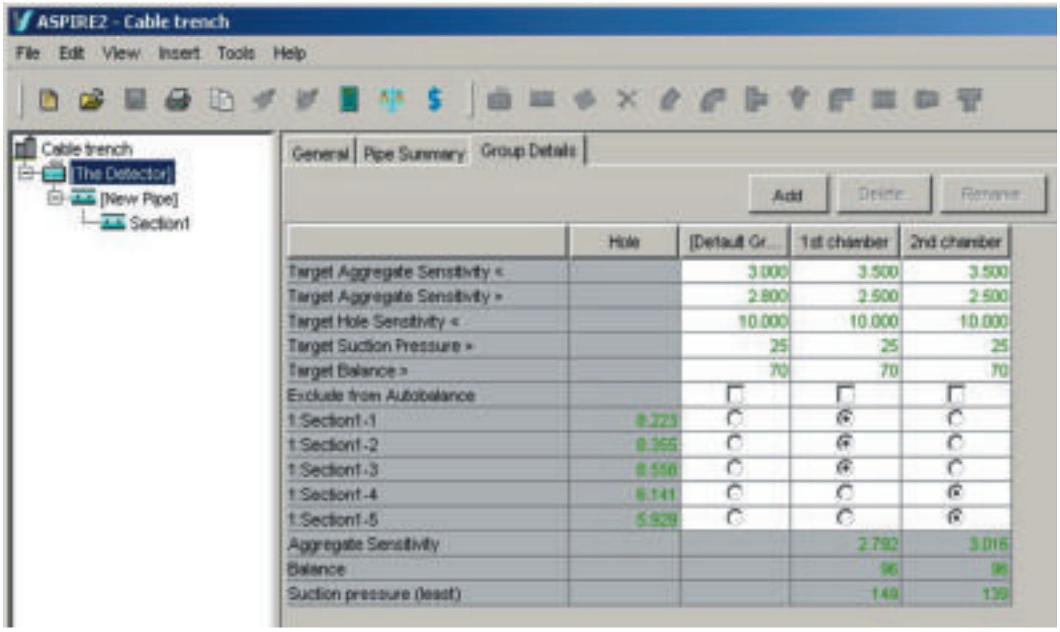
The essential background

It is well recognised that ASD is a different technology to conventional point detectors in that it samples air from a space to detect the first traces of an incipient fire rather than indicating smoke density at specific locations within the space. There are many advantages to this approach, making ASD suitable for a wide range of applications, especially in large open spaces, in fast moving air and otherwise where smoke is diluted.

Despite this fundamental difference, years ago as a "new" technology, ASD was required to prove itself to be *at least as effective* as point-type smoke detectors by passing the fire tests applied to point detectors – specifically the fire test defined in EN54-7.[1] This is still largely the case, even with the recent publication of an ASD product standard, EN54-20,[2] which defines three classes of ASD sensitivity. In this standard, the lowest sensitivity Class C systems must still detect the EN54-7 test fires within an acceptable period, while enhanced sensitivity Class B or higher sensitivity Class A systems must detect much smaller quantities of smoke produced by a new series of "reduced" fire tests. However, even this standard fails to acknowledge the most important aspects of the ASD technique – which is that ASD systems become more sensitive as smoke enters more holes. Why does EN54-20 fail to address this? Quite simply, because it is a product standard, NOT an application standard or code of practice.

Prescriptive codes of practice (such as BS5839-1, VdS 2095, the R7 rules, EN TS 54-14, NFPA 76, and many others) are founded on the performance expectations of traditional point detectors. Essentially, as long as a designer follows the "spacing" rules and uses approved detectors, the protection can be deemed to satisfy the minimum performance requirements. The biggest attraction is that the approach is simple, easy to inspect and has,

Prediction the sensitivity of several sampling holes using Aspire2



over the course of time, been shown to deliver an *appropriate* level of protection.

But what is *appropriate*? What is the performance goal – other than to satisfy the minimum legal requirement and minimise the possibility of disruptive false alarms? Is there any real science to the prescriptive approach or is it simply empirical – founded on experience and tradition?

Science aside, the pervasive prescriptive codes have provided a very effective foundation for the application of ASD systems: simply ensuring that an individual hole can detect the standard test fires and positioning the holes according to the "spacing" rules means that the designer can be assured that the system comfortably *exceeds* the minimum requirements because, in practice, smoke will most likely enter more than one hole.

It is a simple, safe and effective approach to designing ASD systems which practitioners have understood for years and there is now wide acceptance that they work VERY effectively. Indeed, the initial fears that ASD systems would be too sensitive and would result in false alarms have been dispelled by experience. In fact, it is now widely understood that a 'sensitive' detector with multiple levels of alarm can actually *reduce* the risk of costly interruptions to business and operations caused by nuisance alarms. In addition, the availability of products which uniquely achieve very stable calibration through the use of clean air barriers protecting the optical components within the detection chamber has meant that high

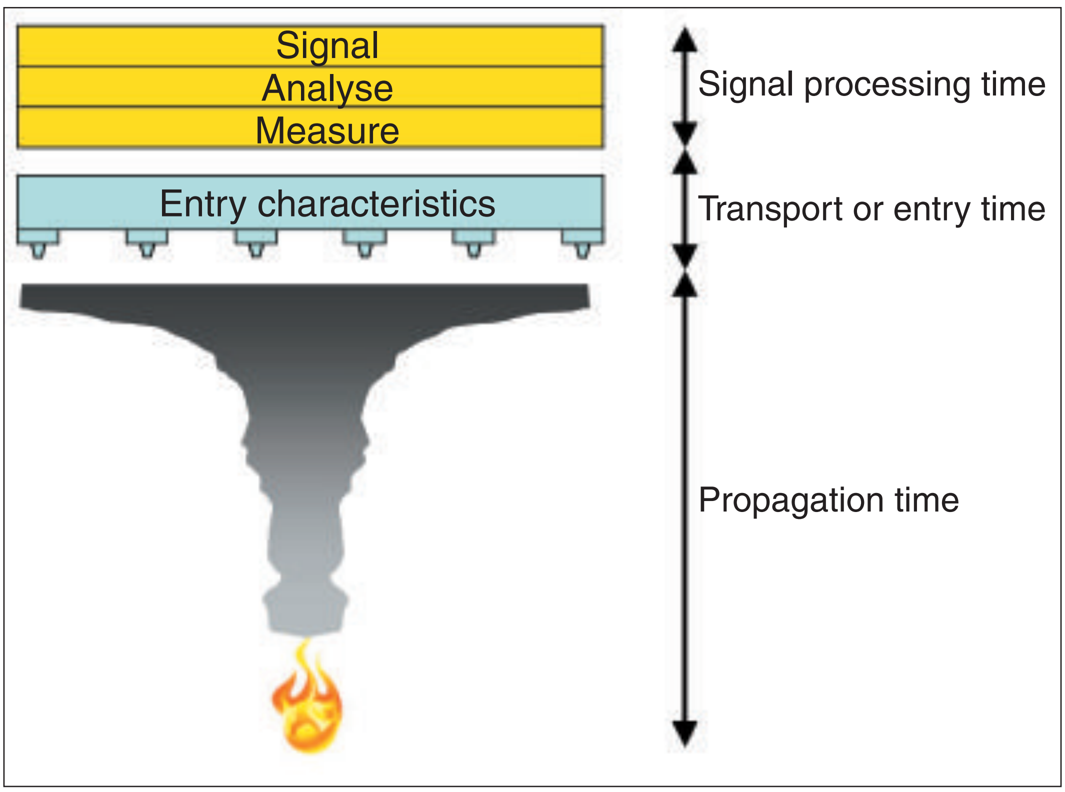


Illustration of the three essential elements that make up the response time of a detector

sensitivity systems can be applied with confidence in a variety of challenging environments.

However, it is arguable that designing ASD systems in line with the prescriptive codes is failing to capitalise on their potential benefits. Fortunately, the modern era of Performance Based Design (PBD) is now upon us and is likely to shape our thinking into the future.

Performance Based Design

This term, which is part of the risk-based approach to fire engineering, is now pervading the international fire protection industry; from structural engineering to watermist suppression, and from evacuation planning to smoke detection. The idea is to match the solution to the risk rather than to simply apply and manipulate a set of prescriptive rules regardless of their suitability. The goal is to achieve better value for money, with greater flexibility of design.

Many of today's complex projects require a risk-based approach. For example the O2 Arena in London has some unique challenges which require innovative thinking to meet clear risk objectives. As such it is widely believed that more projects will follow a performance based approach as the fire engineering techniques needed to predict a system's performance gain credibility and increased usage.

ASD in PBD

Often it is enough to promote an ASD system using a simple model based on elementary logic. The *simple model* being that a single hole can be considered equivalent to a point detector (3rd party approvals offer evidence of this) and the *logic* being that when smoke enters two holes it is twice as sensitive, three holes makes it three times as sensitive and so on. As such, where an ASD system is used, there is some justification for being more relaxed on some other prescriptive rules like escape distances or smoke extraction.

However, to really make a case for such "risk trading" there needs to be a more accurate measure of the risks. This can only be done if there is a quantifiable measure of the real benefit of increased sensitivity when smoke enters more holes. Fortunately, it is now possible.

Predicting the *sensitivity* of several holes

Several ASD manufacturers offer software packages that can calculate the sensitivity of a single hole based on predictions of the flow into individual holes. The basis for this prediction varies but the most accurate are derived from well established flow models (e.g. equations predicting pressure losses in pipes, flow rates through orifices etc) *and* extensive testing to characterise key empirical parameters (e.g. the loss coefficients of pipe fittings and the roughness of pipe walls). While it is relatively easy to manually calculate the sensitivity of a group of holes, once their individual sensitivity is known, only one manufacturer provides software that does this automatically.

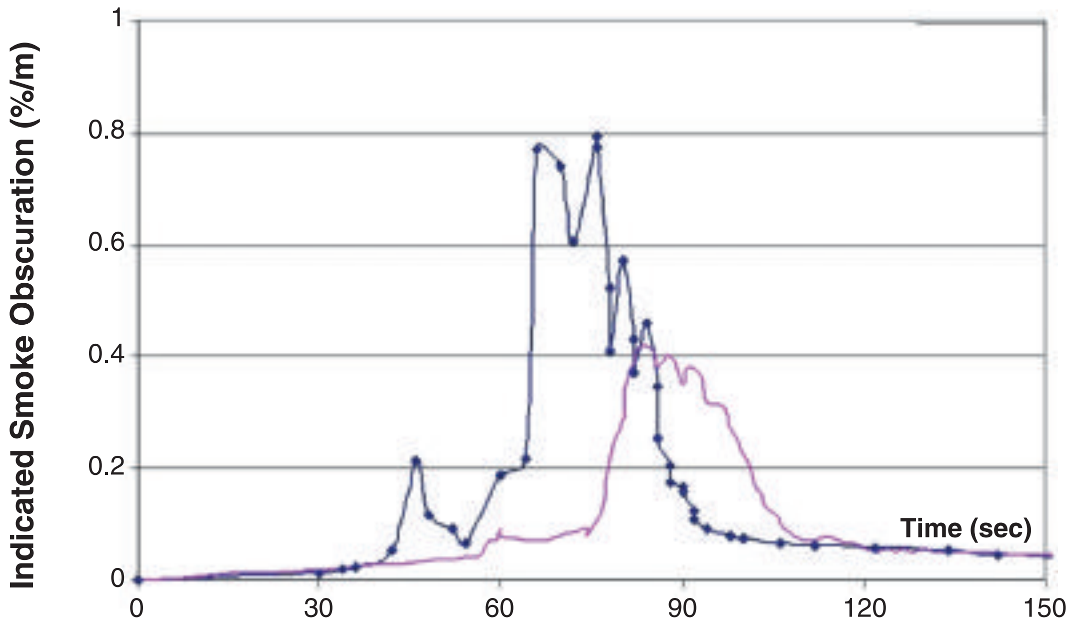
Predicting the *performance* of several holes

While predicting the sensitivity of a group of holes is very useful, it does not account for the real application – i.e. that smoke has to travel to *and into* the point of detection before an alarm is signalled. This is true whether the detector is an ASD system or traditional point-type smoke detector. There are three very distinct steps in both cases. First, smoke must travel to the point of collection (smoke propagation time) then it must enter the detector (transport or entry time) before the smoke concentration is measured, analysed and any alarm conditions signalled (signal processing delay). Any attempt to predict the response of a detector needs to incorporate these three elements.

Predicting propagation time

Smoke propagation times in any particular environment depend on many variables. Fortunately, using CFD (Computational Fluid Dynamics), it is now possible to construct and analyse a model of the space (dimensions), environment (boundary conditions) and fire (heat, smoke density, smoke type, smoke release profile) to predict

Graph illustrating the difference in response of two detectors to the same fire



the smoke density and temperature at any point in the space at any time after the start of the fire. These CFD models have, to date, focused on modeling large fires with significant heat release rates where the thermal flows from the fire dominate the environmental conditions. However, pioneering work is being done to model and verify the results for incipient fires. This work is researching both the combustion process in the immediate vicinity of the incipient fire and the accuracy of smoke propagation predictions when environmental conditions (e.g. flows from air conditioning) dominate.

Entry characteristics – transport or entry time

Once smoke has arrived at the point of collection it takes a finite time to enter the detector. In the case of ASD systems, the transport time (time to transport the sample from a hole in the sampling pipe to the detector) is easy to predict, measure and verify. Typically, transport times are significantly less than 60 seconds – even from the furthest hole, but transport times of up to 2 minutes are generally accepted in the field.

By contrast, for point-type smoke detectors, there is an assumption that smoke enters the chamber almost immediately. In fact entry delays can vary from 2 seconds to several minutes.[3,4] This delay is difficult to predict, – principally because the response is highly dependant on the air flows in the immediate vicinity of the detector, which are needed to drive the smoke in, and the characteristics of the insect mesh which behaves very differently depending on the smoke buoyancy, density and type.

Measurement to alarm – signal processing time

Once smoke has entered the detector, it is measured and analysed to determine if there is an alarm condition. The time that this takes can vary from 3 to over 60 seconds so it is often just as significant as any smoke propagation and entry delays. Moreover, in the case of many detectors, it is often impossible to distinguish between entry and signal processing delays as the only output available is the alarm condition. Where it is possible to observe the analogue reading of a detector, the differences in responsiveness can be significant – as illustrated in the graph above where the inferior detector (represented by the purple line) clearly has a longer integration period, which results in some 15 seconds additional delay and a 50% reduction in the peak signal from a real smoke event.

Using performance predictions to make a difference

The complexity of a model, which combines these three elements, must not be underestimated when developing a PBD. It is essential that the engineer responsible for generating and analyzing the results from any model only derives conclusions that are valid within the limitations of the particular model. Further reading on the modeling of ASD systems is provided by Reference 5.

The following paragraphs describe some real examples of where PBD tools have been used to increase '*confidence*' to assist in the deployment of ASD in specific projects or to provide *evidence* for a change in normal practice

Beam Pockets

A staged report has been published by the NFPA[6] on research into their regulations for smoke detection in a building constructed using deep beams. The research, based on CFD simulations and experiments, illustrates the benefit of ASD technology and indicates that better levels of protection can be achieved by positioning sampling holes inside beam pockets or on the underside of beams.

Atria projects

In practice, point-type smoke detectors have height limitations as they are not generally appropriate for the detection of dispersed smoke in high atria ceilings. These height restrictions are often inappropriately applied to ASD systems. However, on several major projects including Ascot Racecourse in the UK, K2 airport terminal in Hong Kong, and the Gaylord centre in the USA

simulations of fires within the atria have been used to help demonstrate the suitability of ASD to these difficult environments.

Smoke in air-conditioned spaces

A complex environment covering 500m^2 with air handling units supplying air through floor diffusers and extracting it through 18 ceiling extraction fans supplemented by 5 perimeter air handling units, was modelled to compare the response of high sensitivity ASD to beam and point detection technologies. Using a number of different fire scenarios, in various locations, it was shown that the ASD system would provide earlier warning than either the beam or point type technologies.

Suppression Actuation

It is widely known that several ASD systems offer a 2nd Fire threshold specifically introduced to interface to automatic suppression systems. While this feature has been used on many occasions, determining the appropriate smoke obscuration alarm threshold has been considered more of an art rather than a science. Current work, in association with influential fire consultants in the US, is using CFD models to develop a PC based tool to calculate appropriate alarm thresholds for gaseous suppression actuation which match the expected performance of conventional point-type smoke detectors. The tool will account for such variables as the airflow in the protected area and will provide a more application-specific estimate of system performance.

Prediction is the way forward

Increasing use of PBD concepts and developments in CFD are leading to increased confidence in the performance of ASD systems in excess of the prescriptive codes. The most forward-thinking ASD manufacturers are embracing this change by offering a software tool capable of predicting the sensitivity of a group of sampling holes. Moreover pioneering research in the modelling of incipient fires is delivering PBD tools which can be used to compare the performance of different technologies in a wider range of fire scenarios. IFP

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some facts about NITTAN fire detectors!

- We environmentally test ALL our detectors over a 12 hour cycle prior to despatch
- We NEVER batch test
- We were the first to produce a detector that can distinguish between steam and smoke
- We have been manufacturing detectors in the UK since 1972.

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False alarm reduction by use of new technology

Optical Smoke Detection using Dual Light Wavelengths

Application: Ideally suited for the Hotel Industry, HMO's and other areas of Multiple Occupancy, or where spurious events (Steam / Dust) can cause False Alarm situations in standard I.R. Optical and Multi-sensor devices.

By Mark Hunter

Nittan (UK) Ltd

It is generally accepted that optical smoke detectors using the scattered light principle are today taking over the market where once ionization smoke detectors dominated, because the use of radioactive material for ionization smoke detectors has increasingly become controlled by regulation and legislation, and its use and handling restricted.

Generally speaking, the scattered light technology used for commercial detectors is unable to discriminate larger size particles like steam or dust, that are major causes of false alarms, from particles generated by combustion (Fire). Furthermore the optical detector is insensitive to flaming fires when compared to an ionization detector.

To overcome the latter of these weak points of optical detectors, multi-sensor technology has recently been used as the most common solution. For instance, a heat sensor (thermistor) is used to sense a temperature rise, to be combined with the smoke signal from a scattered light I.R. optical, with a specific algorithm to increase the sensitivity of the Optical sensor as the temperature increases.

As a quite different approach to solve these problems, we (Nittan Group) focused on Gustave Mie's (1868-1957) theory on particle light scattering which was published in 1908. This theory suggested the possibility to discriminate smoke particles from non-combustion particles, by estimating the relative difference in particle size, by calculating the ratio of two scattered light sources of different wavelength's.

We expected that it would be possible to eliminate most of the false alarms caused by steam and dust, by discriminating these as large (non-combustion) particles. In addition, it would be possible to make this optical detector more sensitive to flaming fires, by shifting the alarm threshold level when the ratio of the two scattered light wavelengths indicated that the particle size present, was similar to the smallest size defined as a smoke particle.

Background and Theoretical Approach

In the 1990s, a Blue light LED was developed for general commercial and industrial use by Shuji Nakamura of Nichia Chemical in Japan. The combination of this new LED and a conventional Infra-Red LED enabled us to construct a new Optical chamber with the widest difference in the wavelengths of two light sources.

Fig. 1 shows the unique optical chamber which contains two light sources (Blue LED and IR LED) and one light receiving photo-diode. The angle between the light beam and the viewing axis of the Photo diode is designed to be same for the both LEDs.

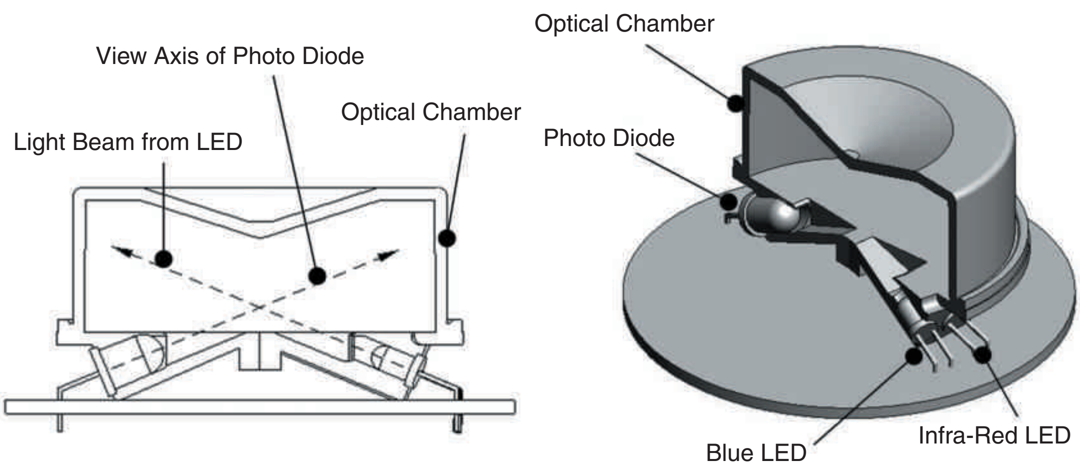
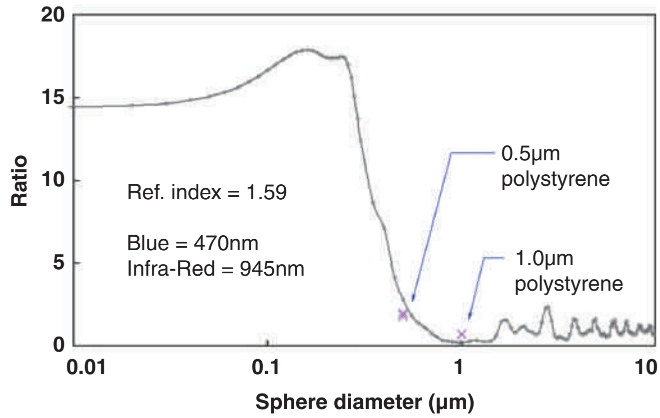


Fig. 1. Optical Chamber containing dual LEDs and a single Photo Diode



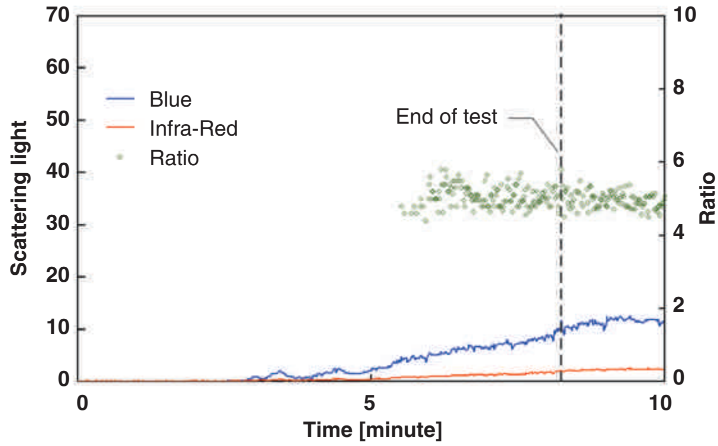


Fig. 2 (above). Ratio of Blue and Infra Red light against particle diameter

Fig. 3 (above right). Scattered light signal from Blue and IR and the Ratio in TF1

The peak wavelength's are actually 945 nm for the Infra-Red LED and 470 nm for the Blue LED.

Using different sized polystyrene sphere particles as a scattering substance, the calculation according to Mie's Theory, was conducted to obtain the ratio of both wavelengths of scattered light in a practical optical chamber mechanism.

The result indicated a potentially large difference in the ratio, influenced by the size of particles, and was verified by the actual measurement, as plotted in the graph (Fig. 2).

Practical Measurement of the Ratio by Application of Test Fires

The Test Fires specified by CEN for Full Scale Fire Test (TF1 to TF5) are considered to cover the majority of fires from combustible products, including wood (cellulosic materials), plastics and liquids, both burning and smoldering. Therefore a detector is considered to be the most ideal if it operates at an adequate level in all test fires.

Optical smoke detectors are basically sensitive to large and gray combustion particles generated by TF2 (Smoldering wood fire) and by TF3 (Smoldering cotton fire) and less sensitive to small combustion particles generated by TF1 (Open wood fire) and black particles by TF5 (Liquid (N-heptane) fire).

Fig. 3 shows the outputs of the Photo Diode from Blue and Infra-Red scattered light and the ratio of these outputs (Blue/IR) in Test Fire TF1. Fig 4 shows those in the Test Fire TF2.

Fig. 5 shows the frequency for each ratio of the two (Blue and IR) wavelength's for TF1 to TF5.

Measurement of the ratio by particles other than combustion materials

The ratio of the two wavelengths was also measured with particles other than combustion materials.

Fig. 6 shows the result of measurement for Steam, Fly Ash (specified by JIS Z8901, Class 5 as a substitute for dust particles) and hair spray. These are representative of the major causes of false alarms for optical smoke detectors.

The graph shows that the scattered light of these particles is not influenced by the Blue and Infra-Red wavelengths, and the ratio is almost 1.0, probably due to their diameter being considerably larger than both wavelength's.

Algorithm for ideal smoke detectors using dual light wavelengths

"It is considered that an ideal Optical smoke detector should be able to demonstrate the following characteristics:

1 The ability to discriminate between combustion and non-combustion particles,

2 An equal response to all CEN Test Fires (TF1 to TF5) – a 'truly flat response',

3 Be able to compensate for contamination,

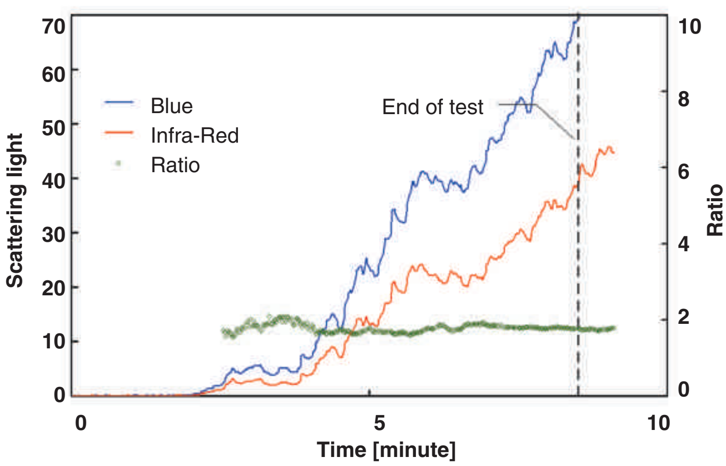
4 To respond to all 'Real Fire Conditions' generated by combustion"

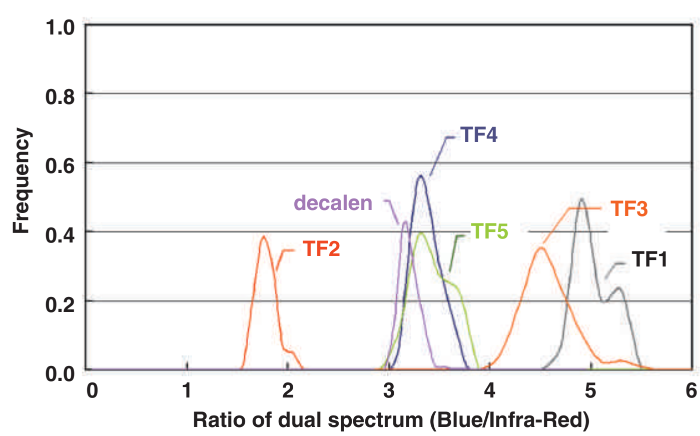
Fig. 5 and Fig. 6 indicate that the discrimination between smoke and other larger particles (steam, dust and hair spray) would be possible by using the ratio of two wavelength's of scattered light (Blue and Infra-Red).

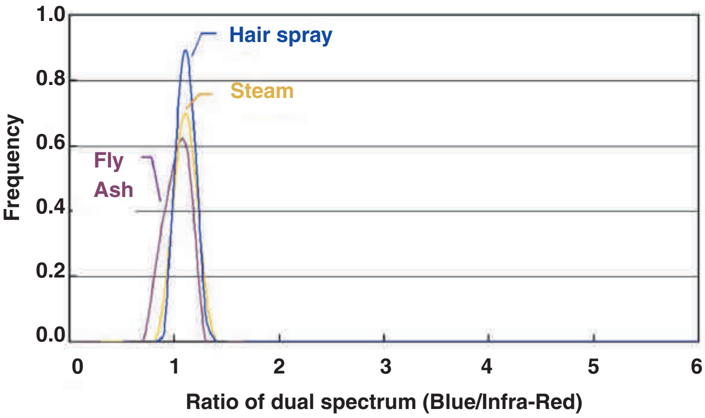
A ratio of <1.4 indicates non-combustion particles, so Alarm should be inhibited (or delayed),

Fig. 4 (below). Scattered light signal from Blue and IR and the Ratio in TF2

Fig. 5 (below right). Frequency to Ratio of two Wavelength's for TF1 to TF5







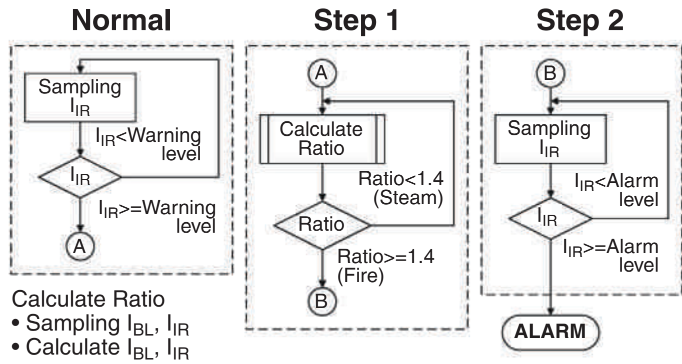


Fig. 6 (above). Frequency to Ratio of two wavelengths for various non-combustion particles
Fig. 7 (above right). Algorithm to discriminate smoke from steam or dust

a ratio >=1.4 indicates combustion particles, so the Alarm condition should be initiated **(1)**.

A detector with this simple algorithm implemented, was introduced into the Japanese market in 2003, and installed in Housing of Multiple Occupancy (HMO's) etc. Extensive Field Trials (>1 year) showed that the detector was very efficient even when installed in a room next to a bathroom/shower room, i.e. reduced False Alarms caused by steam from the bathroom, whilst still maintaining sufficient sensitivity to combustion products to generate Fire Alarms when necessary.

Fig. 7 is a general flow chart representing the logic of the discrimination Algorithm.

In this detector, the scattered light signal from the Infra-Red was mainly used for determination of the threshold value of fire. Blue light was only used to calculate the ratio of the two wavelengths.

A second version of the Algorithm used Blue light for the threshold value of fire, to make it more sensitive to the smaller particles, however when tested in the flaming wood fire TF1, it did not perform satisfactorily compared to an ionization detector.

A third generation Algorithm (Fig. 8) was then developed to improve the response to TF1 (small particle fire). This algorithm also utilizes the ratio of the two wavelength's to compensate for the sensitivity differences to the various test fires.

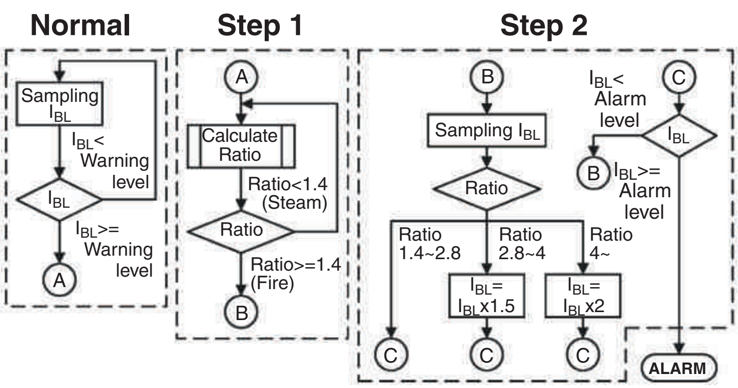
In the step 2 of the flow chart, the smoke is classified into 3 types determined from the ratio of scattered light signals, and then the signal is multiplied by the value (decided by experimentation), according to the ratio as shown in Fig. 8. **(2)**.

In addition, as is now common practice within newer technology Optical detectors, the Algorithm incorporates Drift Compensation, and compensation limit fault indication. (3).

Further testing is on-going in the NKT Fire Test Laboratory, to generate data (similar to Fig. 5) for 'Real Fire' combustion (4).

The Evolution Dual Wavelength Optical Detectors have been designed to meet all the criteria for an Ideal Optical Detector.

Fig. 8. Algorithm with the compensation of sensitivity to TF1



Applications

The Dual Optical Detector is ideally suited for the following sites: -HOTELS, HMO sites (Public Housing) and student accommodation to name but a few. Because the dual optical is such a good all round detector it was recently chosen by Random House Group for its Central London Head Office. The detectors high performance makes it an excellent choice in replacing all standard optical detectors.

Since these new products are mechanically compatible to the older (2KH,2IC,ST) ranges of Nittan smoke detectors it is relatively easy to update older systems to incorporate these 'State of the Art' devices, to solve troublesome site problems.

In addition, since these devices are part of the new 'Evolution™' range, incorporating the 'Omniview™' 360° LED indicator, they offer a stylish, aesthetically pleasing product, with enhanced capabilities over standard Optical or Multi-sensor products.

The EV-DP (Analogue Addressable) is currently supported by Control Panels offered by CEL(Voyager/Discovery based platforms), PSS (Firequest+), and Nittan Group's own EVA-1 – the marine version of which (NSAC-1) is installed on the Queen Mary 2 cruise liner. In this Installation, four networked panels support 8000 devices over 46 loops.

In these Analogue Addressable panels the Algorithm processing is carried out in the Loop Driver Card.

The EVC-DP (Conventional) is available from December 2005, and is compatible with most (if not all) conventional panels with 470ohm Alarm thresholds. The algorithm is carried out by a microcontroller in the head.

Conclusion

The development of these Dual Wavelength Optical Smoke detector's by Nittan Group, is one of the first real breakthrough's in specifically targeting the reduction of false alarms due to Steam and Dust etc.

This is achieved by the use of patented, but cost effective technologies, presented in a stylish, aesthetically pleasing product range which is mechanically compatible to the older (2KH,2IC,ST) ranges of Nittan smoke detectors. IFP

Fire Protection Certification Schemes

– Read The Small Print!

Recently there has been mention in the press and on the internet of 'first party' self certification schemes for installers and their personnel, with regard to the application of passive fire protection systems such as pipe collars, penetrations seals and intumescent coatings for steel.

By The Association for Specialist Fire Protection (ASFP)

A self certification scheme involves an installer, or one of his personnel, issuing a 'Certificate of Conformity' that says that the work has been carried out in the appropriate manner. The Association for Specialist Fire Protection (ASFP) believes that such CoCs are worthless, as they do not carry any independent verification of the work.

Whilst Government backed self certification schemes exist for other industries, for example the FENSA scheme for replacement glass, currently there are no such schemes for passive fire protection in the UK. If you are offered the services of one, or invited to join one, you should ask if it has the 'endorsement' of Government – for England and Wales, which would come from the Department for Communities and Local Government. If the scheme in question does not have this endorsement, you should ask why not, since Building Control, or the Approved Inspector on a job, is likely to ask you this question and will want to know why the scheme has not been placed before Government for scrutiny.

Indeed, the ASFP goes further in the quest for quality passive fire protection, since it is the Association's belief that all passive fire protection work should be carried out not by 'first party', but by 'third party' certified installers.

The ASFP assumed, perhaps naively, that most people in the construction industry understood the concept of third party certification for installers of fire protection systems. A survey carried out by the ASFP contractors' committee, however, found that there was a lot of confusion in the market and in particular from the main contractor and property developer base. Thus its time for a basic course in the nomenclature!

The ASFP assumed, perhaps naively, that most people in the construction industry understood the concept of third party certification for installers of fire protection systems.

You may well ask why the market should have any knowledge of the term 'Third Party'. For that answer turn to 'Approved Document B' (ADB) of 'The Building Regulations 1991 – 2000 Edition' which says:

'Since the performance of a system, product, component, structure is dependent upon satisfactory site installation, testing and maintenance, independent schemes of certification and

registration of installers and maintenance firms of such will provide confidence in the appropriate standard of workmanship being provided.'

And ….

'Third party certification and registration of installers of systems, materials, products or structures provide a means of ensuring that installations have been conducted by knowledgeable contractors to appropriate standards, thereby increasing the reliability of the anticipated performance in fire.'

In addition, the ASFP was especially encouraged to see the following proposed wording in the recent ADB consultation document with regard to third party certification schemes for the installation of fire protection systems:

'Schemes such as those mentioned above may be accepted by Building Control Bodies as evidence of compliance. The Building Control Body will, however, wish to establish, in advance of the work that the scheme is adequate for the purposes of the Building Regulations.'

The ASFP strongly believes that these statements from ADB are the best practise that the construction industry should be striving for to ensure the highest level of fire safety of the UK's buildings. Indeed, all ASFP installer members are third party accredited or working towards third party certification.

Some other respondents to the survey thought that the carrying of CSCS (Construction Skills Certification Scheme) Cards by the operatives meant that their company was third party accredited.

So where does the market's confusion come from? Well many respondents to the ASFP survey thought that approved or recognised applicators, as appointed by manufacturers of products, were in fact third party accredited! This is not of course to say that product manufacturers do not train their installers properly, but this does not extend to them randomly inspecting the installed product on-site!

Some other respondents to the survey thought that the carrying of CSCS (Construction Skills Certification Scheme) Cards by the operatives meant that their company was third party accredited. CSCS aims to register every competent construction operative within the UK not currently on a skills registration scheme. Operatives will get an individual registration card (similar to a credit card) which lasts for three or five years. The CSCS card also provides evidence that the holder has undergone health and safety awareness training or testing. The CSCS initiative is supported strongly by the ASFP, but the scheme registers operatives and not companies and does not provide any inspection of work or company systems.

The ASFP has been heavily involved with the Construction Industry Training Board in the design of the Level 2 and 3 NVQs in Passive Fire Protection. Level 2 is for Installation Operatives and Level 3 for Supervisors. These NVQs demonstrate the competence of the employee and this is assessed by on-site visits and it is the latter that has led to the confusion in some quarters that these constitute some sort of certification/inspection. It does not! This NVQ demonstrates that the holder has been assessed to have a basic competence level in at least two out of the seven possible fire protection modules. The seven modules currently include the application/installation of structural cladding, intumescent coatings, fire rated ductwork, fire stopping and penetrations/cavity barriers, fire rated walls and linings, fire rated ceilings and spray applied materials. The NVQ is a valuable tool in looking at the competence of a company's workforce, but it does not ensure that the work on-site will be of the standard required by the client.

The CSCS initiative is supported strongly by the ASFP, but the scheme registers operatives and not companies and does not provide any inspection of work or company systems.

So, we've looked at what third party certification is not, so what is it?

In the opinion of the ASFP third party certification schemes mean a combination of site inspections, quality management system audits, plus the assessment of the competence of the workforce. Such schemes ensure that passive fire protection installations have been conducted by knowledgeable contractors to the appropriate standards. In addition, these schemes offer a meaningful certificate of conformity that is backed by a third party (the scheme organiser) and this will add confidence to the client that the passive fire protection in his or her building has been installed properly. Given the increased responsibilities of the 'Responsible Person' under the Regulatory Reform (Fire Safety) Order, it would seem sensible for them to insist upon the use of third party accredited installers for the passive fire protection in their buildings.

In the opinion of the ASFP third party certification schemes mean a combination of site inspections, quality management system audits, plus the assessment of the competence of the workforce.

So remember, there is no space for naivety or confusion in the installation of passive fire protection – it's a life safety item. So read the small print with regard to any schemes that are offered to you.

In the ASFP's opinion there is no alternative to having fire protection systems installed by a third party certified installer. IFP

Emergency Show and Audible and Visual N

For most of the 20th century it was widely assumed that an evacuating population should be deprived of information regarding an emergency incident (e.g. a fire), as it would have instilled panic.[1,2]

By S.M.V. Gwynne

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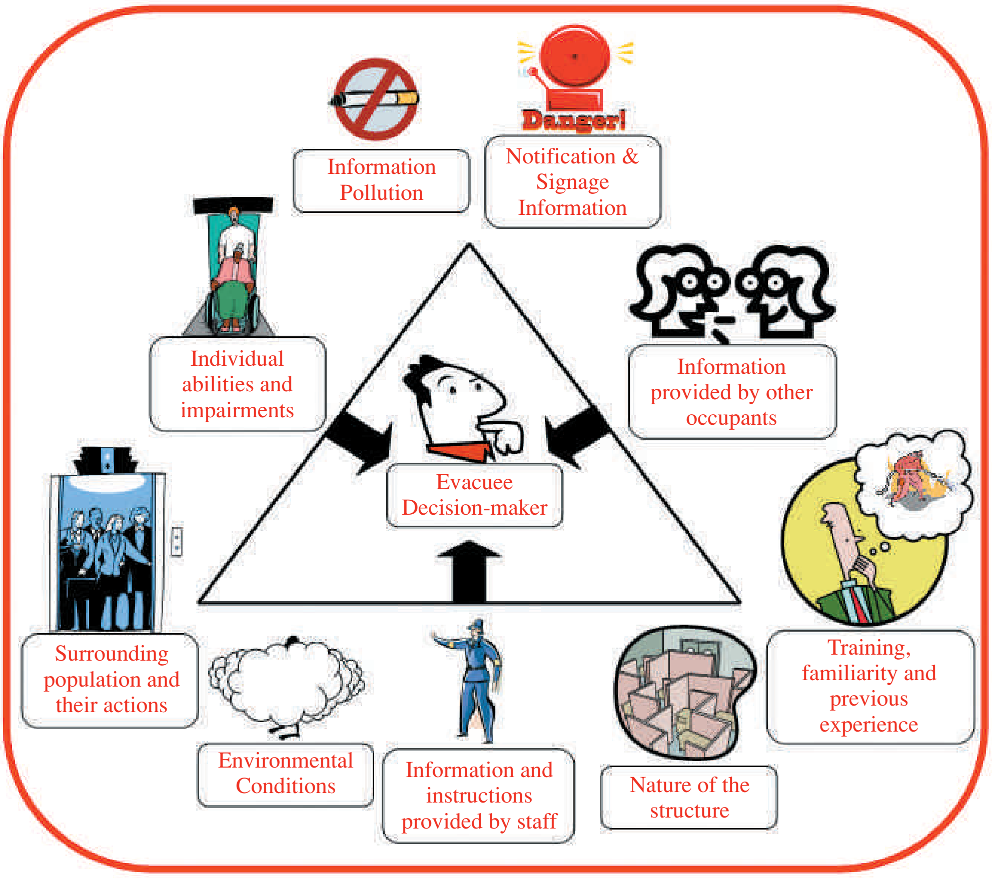

Figure 1. Sources of information and factors that might inhibit its receipt

This point of view has been replaced, through advances in our understanding of human behaviour, by the view that the population needs to be informed of the event necessitating their evacuation, as early and comprehensively as possible in order to increase their acceptance of the emergency procedures and inform their decision-making process.[3] Indeed, it is now widely accepted that depriving evacuees of information increases their probability of performing irrational or sub-optimal actions.[4]

The process of managing an evacuation is also aided by the evacuees knowing what they are doing and why. This response can be compared to attempts at crowd control where a population is coerced into acting in a specific manner without explanation.[4,5] Given that it is now considered desirable to inform the evacuees of the incident, the question then becomes how we do so most effectively. How do we ensure that the population is aware of the incident, the potential threat and the best response available? This article examines two technological methods of approaching this problem, the use of visual and aural notification systems, and places them in context with the incident environment.*

Responding in Time

An emergency incident can be a rapidly developing situation in which information is an invaluable commodity. Amongst other things,[2,4,6-8] it is imperative that evacuees respond in a timely fashion to a fire, and this response is dependent upon the information available. It is often the case that the time to respond to an incident can seriously prolong the overall time required to reach safety.[2,4,9-10] This time can be influenced by a number of variables (see Figure 1). Information can arrive (or be sought) from a variety of different sources that vary greatly in their reliability and accuracy. Where there is ambiguity or

*The author is currently engaged in examining the effectiveness of different notification technologies on alerting large groups of an incident and then informing them of how to respond. This work is funded by the Fire Protection Research Foundation of the National Fire Protection Association (see www.nfpa.org for details).

nd Tell: The Use of Notification Systems

conflicting information, precious time can be spent confirming the existence of an incident and nature of the hazard posed. In addition, this information can be misinterpreted or missed entirely. The notification process represents an attempt to compensate and correct for these omissions.

It is also vital that once the population begins evacuating, they are aware of the egress routes available, use them efficiently, and do not waste time wayfinding. Therefore, when designing an emergency procedure, two basic behavioural components need to be addressed: ensuring that people are alerted of the incident sufficiently quickly and in adequate detail; and ensuring that the population responds in the most efficient manner possible.

The Tools Available

Given this, the emergency planner must use the procedural tools available to manage these two components. These tools and their inherent limitations include:

Managing the normal use of the structure and therefore maximising the population's familiarity with the routes available, improving the likelihood of their use during an incident.

Transient populations and the structure's use may limit the ability to do this. If people are only infrequent visitors to a building (e.g. a shopping centre, a hotel, a transport terminal, etc.) then it may be practically impossible to sufficiently familiarise them with the routes available.

Ensuring that the design of the structure affords the population some protection and provides them with a sufficient number of egress routes.

Although viable, the nature of the incident may reduce or modify the routes available. This may overload certain routes, reduce the individual's understanding of the layout of the structure and may make some locations particularly vulnerable (e.g. especially those locations where only a small number of routes were originally available). There may also be commercial and aesthetic concerns that infringe upon the provision and design of redundant egress routes.

Training to ensure that the population is aware of what they should do in times of emergency.

Although this is an important method of ensuring an appropriate response to an incident, it is difficult to successfully apply this approach for infrequent visitors to a structure. In many environments (e.g. an office) it is difficult to sufficiently train the general population to the necessary degree due to time constraints, the potential for disruption, and a general unwillingness to engage in safety training.[4]

Emergency drills or exercise are performed to ensure that the emergency procedures are effective and that the population is capable of employing it

For technical, financial and ethical reasons, it is difficult to perform a fire drill with any degree of realism.[4] *Prior warning is often provided, allowing the population to avoid the test altogether, or leave reluctantly. This gives a false impression of the effectiveness of the procedure and may not adequately familiarise the population with the emergency procedure. It is also difficult to conduct these drills involving infrequent visitors to a structure.*

Deployment of trained and assertive staff to assist evacuees and manage the overall evacuation process.

It is vital to have trained staff present, but given the incident scenario and the complexity and size of the structure, there may not always be a member of staff at hand. Relative to some of the technological methods available, the involvement of a sufficient number of staff is expensive – both in terms of their employment and the necessary training required to instil the procedures and convince them of their responsibilities (compare 7 with 8).

Given the potential issues with the procedural measures highlighted, the inclusion of technological notification and guidance solutions that alert and inform the population of the incident is often an attractive and relatively cost-effective means of aiding evacuees. The employment of visual and audio information systems will be described below, along with what can realistically be expected of them and when they might be implemented. For their successful implementation, it is important that the limitations of these systems are understood.

The Good, The Bad and The Necessary

From the research literature[11] it appears that the *most* effective means of informing an individual of an incident is through the presence of a well-informed, well-trained, assertive[12] and respected member of staff instructing occupants of the incident. Not only is the message perceived to be more credible,[3] but the member of staff is also able to provide updates and adapt the information as the incident requires. In addition, they are able to physically intervene where necessary, encouraging evacuees to move in a particular direction, move at a particular pace, and generally assure them that the incident is real and not a drill or false alarm.[4,11-12] Therefore they provide an excellent means of initiating and managing the evacuation process.

If a member of staff is not present, then other means of influencing the evacuation needs to be provided. In their absence it is critical that an information vacuum be avoided. The worst-case scenario would be that in this information vacuum the occupants would respond after an extended period of time and then evacuate in a disorganised manner, overloading some egress routes whilst underutilising others. In contrast, with sufficient information and management, the evacuation can be managed in order to reduce the likelihood of conditions deteriorating.

Table 1. Examples of Audible and Visual Notification Systems

System	Nature	Information provided
Siren, Horn, Bell	Audible	Indicates that an event has occurred
T-3 Signal	Audible	Indicates that an emergency has occurred, assuming that T-3 is suggestive of an emergency[13-15]
Voice Recording	Audible	Indicates that an incident has occurred and may also provide response guidance. The nature of the incident and the response will need to fall within the library of stored messages.
Directional Noise	Audible	Indicates that an incident has occurred and provides guidance on the location of exit locations[16]
Live Announcement/Paging	Audible	Indicates that an incident has occurred and may also provide real-time response guidance. Assuming that a procedure exists to determine the response, the method is flexible enough to provide relevant information.
Strobe	Visual	Indicates that an event has occurred
LED Textual Signs	Visual	Indicates that an event has occurred and may allow limited information to be provided.
Display Screens	Visual	Indicates that an event has occurred and may allow information to be provided on the required response.

It may then reasonably be assumed that the effectiveness of a member of staff provides an upper bound for any other technological solution; i.e. it is unlikely that a technological solution will surpass the effectiveness of a well-trained, well-informed human solution both in terms of initiating and responding to the incident (see Figure 2). The flexibility and credibility of committed staff can then act as a benchmark for the performance of notification technologies.

A useful analogy regarding the possible impact of notification via technological systems as compared to a managed procedure (conducted by staff), relates to telephone operators. It is now common for businesses to automate telephone services as much as possible for various reasons (primarily cost and convenience). The caller is then faced with a number of pre-recorded conversations and is required to navigate through the process without the aid of another person. This works assuming that: (1) the caller is reasonably familiar with the whole process; (2) the individual understand the information provided and the alternatives available; (3) the individual is able to operate the telephone; (4) the individual does not make a mistake; (5) the individual does not have physical or cognitive impairments that affects their successful use of the system; (6) the options provided cover the requirements of the caller. In reality, even relatively experienced users of such systems can get lost, frustrated and need to start again through making errors. If an operator was present to receive the call (assuming that they are sufficiently trained) then they should be able to address the issues of the caller, and adapt the services offered to cater for them. In addition to this, the caller often feels more comfortable with the human counter-part, accepting guidance from them more willingly and being more likely to engage in the process. Similar issues arise when comparing the effectiveness of notification technologies with trained staff.

However, there will be situations where staff is unavailable, or where they need support. In these situations, notification technology is a critical tool. Even though it may not be as effective as a member of staff, it is the next best thing. As with staff actions, video and audio information systems are used to inform occupants of the existence of an incident and then, ideally, aid their response to ensure safe egress. The evacuation process requires the occupant population to recognise that an incident is sufficiently hazardous to require a change in their behaviour, such that they respond.

Preaching to the Converted

In essence, the provision of information via notification systems compensates for deficiencies in the existing information levels in the occupant population. Visual and audible notification systems are employed as they increase the likelihood of reaching the occupant population given the different conditions that might arise and the abilities of the occupants themselves. The success of both of these approaches, along with several others,[3,4,11] is dependent upon the resolution of a number of questions, prior to the occupant appropriately responding to the incident[3]:

- Is the information produced by the notification system received?
- Is the information perceived by the occupant as representing an emergency?
- Does the information lead the occupant to identify an appropriate response?
- Is the individual then able and willing to perform this response?

In order for the notification to successfully produce the desired effect, whether it is provided by technology or by staff, the information provided (whatever its format) needs to be received, understood and followed. The information also needs to be accurate; however this will be largely be dependent upon other aspects of the emergency procedure (e.g. reporting systems, sensors, CCTV, etc.).

It is apparent in Table 1 that the nature of the information provided by an audible system can vary significantly. The most basic information indicates the occurrence of an incident through the sounding of a tone. The proliferation of tones, alarms and security devices may reduce the association of a particular tone with an emergency incident.[4] Particular tones have been developed (e.g. the T-3 signal) that are more readily associated with an emergency in an attempt to combat this problem.[13-15] Irrespective of this, neither type of signal indicates in sufficient detail the required response of the population; it only indicates that a response is required.

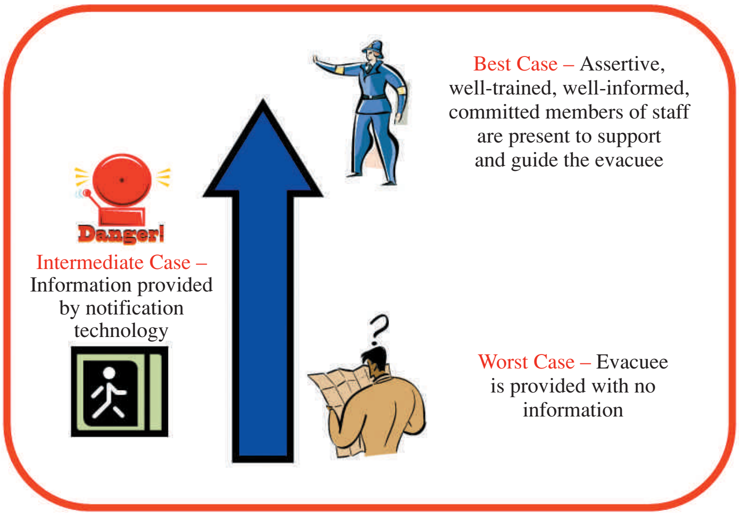

Figure 2. The continuum of effectiveness in notification – ranging from no activity to the presence of a well-trained and assertive member of staff. In between there are a range of different notification technologies available

To combat this, voice messages can be provided to not only describe the existence of an incident but the required response of the population. The benefits of this type of system are particularly evident where the required response is complex (e.g. a phased evacuation), where the population needs to act in a counter-intuitive manner or where the population is unfamiliar with the necessary response. However, the pre-recording of messages requires that a set of incidents and conditions has been pre-determined limiting the scenarios that can be described and the responses that can be suggested. A live voice system is not restricted in the same way, although certainly requires a trained operative, with current, accurate information.

Similarly, visual systems range in their ability to initiate the evacuation and then influence evacuee behaviour. Strobes are often present in public spaces to grab the attention of occupants and inform them that an event has occurred. However, even if this information is accepted as indicating an incident, it provides no further information relating to the nature or seriousness of the event, nor information on the required response. Other visual devices can be employed to represent this type of information, including the use of screens, displays, etc. In these cases, it is critical that they are placed in a position where they are visible such that the full message is available to as wide an audience as possible. The information provided by such devices will normally be pre-determined in nature given the difficulty of producing visual instructions in a short period of time. However, these instructions could be more detailed (e.g. including maps) if a screen was employed.

Engineering Egress

There are a number of technological alternatives available for audible and visual notification systems

Table 2. Examples of factors that can interfere with the two notification technologies

Audible	Visual
Physical Factors	
Is there sufficient coverage?	Is the information blocked by physical obstacles;
Does the audible signal/message reach the required population? Are the sound levels appropriate for this to occur, whilst not being prohibitively loud in certain areas?	e.g. the design of the structure, furniture, etc.?[17-19]
Environmental Factors	
Is there background noise inhibiting the receipt of the sound?	Are there non-emergency lighting, screens, advertising hoardings, etc. that detract from the emergency information?
	Does the presence of smoke interfere with the information provided?
Individual Factors	
Are there individuals that are hard of hearing?	Are there individuals that are visually impaired?
Are there individuals that are cognitively unable to evaluate the information provided?	
Situational Factors	
Is the message perceived to represent a fire emergency?	
	Is the population expecting a visual message?
Is the system susceptible to false alarms? Will this then influence the perceived veracity of the notification system?	
Do the occupants comprehend the message provided?	
	Is the population focusing elsewhere (e.g. engaged in another activity such as using a PC, watching TV, etc.) and is therefore less likely to receive the information provided?

(as shown in Table 1). These have different strengths and weaknesses that can be broadly categorised according to:

- Whether they provide information on the nature of the response or not?
- Whether this information is pre-determined or adaptive?

In addition, the two approaches are susceptible to a variety of factors that can influence their effectiveness. A selection of these can be seen in Table 2.

Key Notification Issues

Given the previous discussion, there are some basic requirements regarding the notification technology irrespective of whether it is visual or audible (or anything else):

– It must have the maximum coverage possible. Those that are able to receive the information should be able to receive it. It should be recognised that when employing either system there will be a proportion of the population that will not be able to receive the information provided (e.g. the impaired). Alternative measures will need to be taken for these individuals (e.g. the intervention of staff, vibrating devices, mobile devices, etc.).

– The social context of the information should be understood and managed if possible; e.g. will people recognise the information as actually representing a real incident. Technical issues that lead to false alarms, or the misinterpretation of the message as non-emergency, should be addressed.

– The information provided should not only indicate the need to respond but the required response. This may be targeted to certain populations according to location or proximity to the incident. For instance, the emergency procedure may be staged, requiring only sections of the population to move at any one time. This may also reduce the perception of unnecessary activity, i.e. moving when it is not necessary, possibly being equated by the population to a false alarm.*

– Irrespective of whether the required response is uniform or not, the information provided should be based on the most current data available and should reflect the emergency procedures in place. The notification system would then form an integral part of the procedural strategy by keeping the evacuating population informed of the evolving conditions.

Ideally, a notification system should be formed from technological and human solutions. Not only will these two sources of information act to reinforce the reality of the incident, it will increase coverage and introduce much needed redundancy into the system.

Conclusion

Visual and audible notification systems are a vital tool in an emergency response procedure. They have the potential for providing detailed information to the occupant population, both indicating that an event has occurred and the desired response to it. As such, they support the emergency procedure in place. However, just as it would be irresponsible to design a system that was totally reliant upon the presence of staff and their actions, given the possibility of their injury or absence, it would also be overly optimistic to assume that a purely technological solution would

*In some environments the disruption caused by a full evacuation can be significant (e.g. at an airport where security issues and commitment issues may prevent occupants from evacuating where not obvious cues are present). Therefore, where appropriate, staged/zoned evacuations can be conducted where only sections of the population are moved, managing the evacuation conditions, and possibly limiting the disruption.

'solve the problem' on its own. In an ideal situation, the technological and human resources would be employed in support of each other to ensure coverage, detail and accuracy. IFP

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UNIFRAX

Fire rated Shaft Enclosure

Will Fire Resistive Gypsum Shafts continue to be the best available Option?

Recently, there has been a significant increase in the number of manufacturers providing tested and listed fire resistive duct enclosures for grease and ventilation duct systems as alternatives to fire rated shaft wall construction. For the first time in the International Code Council history, the 2006 International Mechanical Code now specifically defines the required test methods for fire resistive duct enclosures for grease duct systems.

By Brian P. Carnazza

RJA

The change requires field applied grease duct enclosure assemblies to comply with ASTM E2336, while prefabricated, factory built, systems should comply with UL 2221. Although these code changes only apply to fire resistive duct enclosures for grease duct systems, it is significant because for the first time the code clearly recognizes an alternative to the fire resistive shaft construction enclosure assembly, which is tested in accordance with ASTM E 119/UL 263. The article examines the existing industry of fire resistive duct enclosure systems and future impacts on fire rated gypsum shaft requirements in Codes.

2006 International Mechanical Code

a. **506.3.10 Grease duct enclosure.** A grease duct Ducts should be enclosed in accordance with the *International Building Code* requirements for shaft construction. Clearance from the duct to the interior surface of enclosures of noncombustible construction or **gypsum wall board** attached to noncombustible structures shall be not less than 6 inches (152 mm).

i. 1. The shaft enclosure provisions of this section shall not be required where the surface of the duct is continuously covered on all sides with a classified and labeled material, system, method of construction or product specifically evaluated for such purpose, in accordance with ASTM E 2336.

ii. 2. The shaft enclosure provisions of this section shall not be required where a prefabricated grease duct enclosure assembly is protected on all sides from the point at

ASTM 2336 Internal Fire Test

which the duct penetrates a ceiling, wall or floor to the outlet terminal with a classified and labeled prefabricated system specifically evaluated for such purposes in accordance with UL 2221.

Today's code requirements for shafts

The 2006 International Building Code Section 707 requires a shaft wall for any opening within a floor slab assembly connecting more than one floor. There are a number of exceptions which omit shaft construction such as firestopping pipe penetrations per ASTM E 814. In general, penetrations by HVAC ducts of floor assemblies are to be enclosed in shafts that are constructed in accordance with Section 707.

The fire-resistance rating of the fire barrier gypsum wallboard assemblies separating building areas from a shaft are tested in accordance with ANSI/UL 263 (ASTM E119 and NFPA 251), "Fire Tests of Building Construction and Materials." The ratings are expressed in hours. Wall systems evaluated under ASTM E119 are typically full-scale assemblies with an exposure of 100 square feet of wall to the fire, with a minimum wall dimension of 9 feet.

The acceptance conditions under ASTM E119 consists of the wall assembly withstanding the fire-endurance and hose stream portions of the test, without any openings occurring in the wall system and with minimum transmission of heat through the assembly.

Shaft Alternatives

Shaft alternatives (fire resistive grease and ventilation duct enclosure systems) were created as a space and labor savings alternative to the typical fire resistive gypsum shaft construction. Costs aside, the use of a field-applied or prefabricated fire resistive duct enclosure system is far more appealing to mechanical engineers, contractors, and architects since it provides design flexibility and allows complex ductwork configurations.

Fire resistive duct enclosures have been fire tested to standards that evaluate the system in the configuration that would exist in the field (enclose a full-scale duct system tested in horizontal and vertical orientations, under operational temperatures and fire conditions). Shaft enclosures are tested as a wall per ASTM E119, a configuration that does not match the orientation of the system when installed as a four sided enclosure for a duct operating at elevated temperatures for extended periods of time.

Grease Ducts

The fire resistive performance of a grease duct assembly is investigated in accordance with ASTM E2336 or UL 2221. The International Code Council Evaluation Service first developed an Acceptance Criteria for Grease Duct Enclosure Assemblies in 1994, AC101. The AC101 acceptance criterion was developed to provide an evaluation method for fire resistive grease duct enclosure systems since no such criteria existed within the model codes.

ASTM E2336 was developed to mirror the AC101 acceptance criteria but contained mandatory language that could be referenced in the code. ASTM E2236 is used to evaluate any type of grease duct enclosure system, field applied or prefabricated. UL 2221 was developed concurrently with ASTM E2336, but specifically addresses methods for evaluation prefabricated duct enclosure systems.

The majority of design listings and labeled materials in existence today are based on the provisions of the ASTM E2336 standard. This test method evaluates the enclosure materials and the grease duct enclosure systems using the following test methods: noncombustibility, fire resistance, durability, internal fire, and fire-engulfment with a through-penetration fire stop.

The internal fire portion of ASTM E2336 consists of the temperature inside the duct being raised to 500°F (260°C) and maintained for a minimum of four (4) hours. The temperature is then raised to 2000°F (1093°C) within 15 minutes and then maintained for an additional 30 minutes.

The fire engulfment test involves simulating an exposure of the enclosure system to fire occurring from an outside source. A 10 foot long and 4 foot high L-shaped duct assembly is tested in a horizontal furnace under the conditions required in ASTM E119.

Advantages

The primary advantage of field applied or a prefabricated fire resistive duct enclosure system is the space savings. When a gypsum wallboard shaft is utilized, the inside layer of the wall board shaft is required to be no less than six (6) inches from the duct surface. One of the possible reasons for such a clearance requirement is that the fire resitivity of gypsum relies on it's ability to release water as it is heated; however, when exposed to constant high temperatures such as when a grease duct is continuously used during business operations, it can slowly dry out over time and lose its endothermic fire resitivity characteristics. Alternative products have been tested with zero clearance to combustibles so that the unexposed enclosure surface can be in contact with combustible construction material. The space savings aspect of fire resistive grease duct enclosure systems and ease of installation for tight spaces has given it the needed momentum to make its way into the IMC as an accepted alternative.

HVAC Ducts

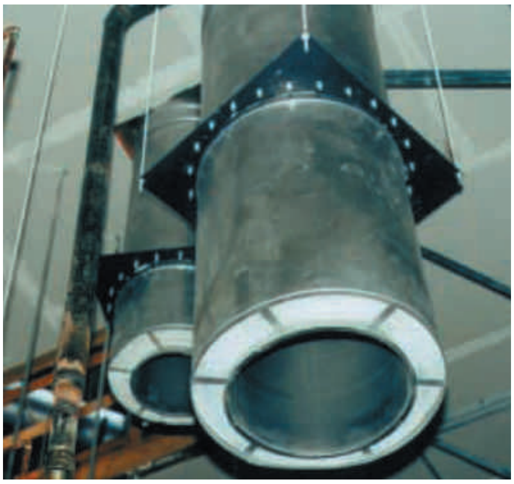
In addition to the new grease duct shaft alternative provisions in the IMC 2006 Code, the ICC ES introduced a new Acceptance Criteria in 2005 for Metallic HVAC Duct Enclosure Assemblies, the AC179.

AC 179 includes testing the duct assembly as a wall in accordance with ASTM E119 for the desired hourly rating, identical to how gypsum shaft wall assemblies are tested. To date no manufacturer has a tested and listed system in accordance with AC 179. Discussions within the fire resistive duct enclosure community are on going to determine if AC 179 is representative of actual field conditions. It is anticipated that minor modifications will be made before manufacturers of enclosure systems begin listing and testing per AC 179.

The introduction of AC 179 in 2005 is analogous to the introduction of the AC101 for Grease Ducts in 1995. A decade later, fire resistive grease duct enclosure systems are cited in the IMC as acceptable alternatives, will the same be true for ventilation ducts, in five (5) to ten (10) years?

The AC 179 also consists of testing the field applied or prefabricated enclosure system in accordance with ISO 6944-1985, "Fire Resistance Tests – Ventilation Ducts." Two duct configurations can be tested, Duct A or Duct B. Duct A consists of a closed duct system with a vacuum drawn from within the duct while it undergoes the furnace engulfment test. Duct B is an open duct system tested to the same fire curve as Duct A. The ISO 6944 is tested to the ISO 834 time temperature fire curve, which is similar to the ASTM E119 fire curve.

Similar to how ASTM created ASTM E2236 based on the ICC ES AC101, ASTM is working on a draft to standardize a fire test method for fire enclosures of ventilation ducts. The ventilation duct test criteria will be more complicated and will have options for testing such as open and closed systems because ventilation ducts are used in several ways. Such as typical supply air distribution in buildings, smoke control exhaust, and stair and elevator shaft pressurization.



Prefabricated fire resistive duct enclosure system

Advantages

Currently ventilation duct standards (ISO 6944 and AC179) are designed only to evaluate fire performance of ducts with protection systems. Neither the current testing, nor the draft ASTM method currently includes provisions to evaluate the impact of damper removal. In addition fire resistive duct enclosure manufacturers and the International Firestopping Council (IFC) are not lobbying to develop test standards or products specifically designed to replace code required fire dampers used in ventilation duct systems.

Similar to the motivation for fire resistive grease duct enclosure systems, space savings is the key theme. However, it would be a very marketable feature if the use of fire dampers was unnecessary with a tested ventilation duct enclosure system, from a cost and maintenance perspective.

Summary

In years past, opportunities for shaft alternatives were limited due to the familiarity and widespread acceptance of ASTM E119 tested gypsum wallboard shafts. Over the past decade, test standards for evaluating grease and ventilation duct enclosure systems have been developed and are being integrated into national and local mechanical codes. Fire testing results have validated system performance as a shaft alternative, and extensive installation experience has allowed manufacturers to clearly define the space and labor savings which are a benefit to designers and installers. The market has embraced fire resistive duct enclosures as a viable alternative to shafts and opportunities for these systems will continue to grow as test standards and codes continue to be further developed. IFP

ISO 6944 Ventilation Duct Test

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Fire risk assessments – your duty as an employer

As part of a commitment to reduce death, injury and damage caused by fire, the Government has reviewed the current fire safety law and is making a number of changes through the Regulatory Reform (Fire Safety) Order 2005 (RRFSO) which will become law on 1st October 2006.

By BRE

The main effect of the changes will be a move towards greater emphasis on fire prevention in all non-domestic premises – offices, shops, factories, leisure and other buildings. As part of the requirements to comply with the Order, the 'responsible person' is required to carry out a fire risk assessment of the premises. This could be the employer, business owner, company director, or a senior manager who has overall 'control' of the building or site.. They may employ or instruct a 'competent person(s)' to undertake this task on their behalf.

The fire service will no longer make requirements for fire precautions and issue fire certificates but will enforce the new regulations through inspection of the assessment.

To assist people carrying out risk assessments the Department for Communities and Local Government (DCLG), have commissioned a series of eleven guides. BRE assisted in the preparation of eight of these guides as follows:

- Offices and Shops (drafted by DCLG as a template)
- Premises providing sleeping accommodation

- Residential care
- Small and medium places of assembly
- Large places of assembly
- Factories and warehouses
- Theatres and cinemas
- Educational premises
- Healthcare premises (responsibility of the Department of Health)
- Transport premises and facilities
- Open air events

To assist in the development of the guides, stakeholder groups were set up with representatives from the fire industry, enforcers, local and national government and organisations who represent the tyes of premises covered by specific guides. Visits were made to a range of representative premises to identify risks, good practice and fire safety lessons learned in order to ensure the guides were both relevant and meaningful to the 'responsible person'. They were also cross referenced to other relevant documents and legislation such as Approved Document B, the NHS Firecodes and British Standards.

The guides are not prescriptive but provide guidance and recommendations for use when carrying out the risk assessment and addressing issues that may arise relating to fire precautions.

Each of the guides is written in two parts:

- **Part 1** – The five step approach to fire risk assessment
  - **Step 1** Identify fire hazards
    - Sources of ignition
    - Sources of fuel
    - Sources of oxygen

- **Step 2** Identify people at risk
  - People employed in the premises
  - People who visit the premises
  - Members of the public using the premises
  - People in the vicinity of the premises
  - People especially at risk
- **Step 3** Evaluate, remove, reduce and protect from risk
  - Evaluate the risk of a fire occuring
  - Evaluate the risk to people from fire
  - Remove or reduce the fire hazards
  - Remove or reduce the risks to people
    - Detection and warning
    - Firefighting equipment
    - Escape routes
    - Lighting
    - Signs and notices
    - Maintenance
- **Step 4** Record, plan, inform, instruct and train
  - Record significant findings and action taken
  - Prepare an emergency plan
  - Inform and instruct relevant people
  - Co-operate and co-ordinate with others
  - Provide training
- **Step 5** Review
  - Keep assessment under review
  - Revise where necessary

- **Part 2** – Detailed guidance on identifying fire hazards and risks, fire precautions, fire protection equipment and systems, means of escape and management of fire safety.

The guidance is supported by diagrams, illustrations, case studies and checklists to assist someone carrying out the risk assessment

Each of the guides contains appendices detailing the following information:

- Sample checklists and recording forms
- Technical information on fire resisting separation, fire doors and door fastenings
- Historic Buildings
- Glossary of terms

All of the guides contain a section on 'Quality assurance of fire protection, equipment and installation'. This section supports the guidance given throughout the guide that when specifying, purchasing and maintaining fire safety equipment, competent installers and organizations should be used. The guide emphasizes the benefits of using third party certification schemes for such services as they provide the most effective assurance with regard to level of quality, reliability and safety of the product or service purchased.

The 'responsible person' is required to consider people in the vicinity when carrying out the risk assessment. Thus the potential of fire spread from the property and particularly outdoor storage needs to be a factor of any risk assessment and emergency plan.

BRE has used its extensive knowledge of fire to develop a comprehensive Fire Risk Assessment methodology linked to a series of in-house training courses dealing with Fire Risk Assessment and the RRFSO. BRE has also implemented a competency scheme to evaluate the performance of Fire Risk Assessors. A comprehensive fire risk assessment together with proper fire safety management is the first line of defence from the devastating effects of fire.

This together with the approved products and installers of fire protection products listed by LPCB (BRE's sister company) places BRE in a uniquely authoritative position to both train fire risk assessors and carry out fire risk assessments itself. Further information can be found at www.bre.co.uk/firerisk.

Guides

BRE has also published a number of sector based guides which explain in very broad terms how fires start and spread. They also review fire safety measures and discuss the issue of escaping from fire. They also include a fire safety checklist and information on where to go for specialist help and training. *Fire safety in hotels* was the first in this series of guidance documents and was followed by *Securing your Hotel.* Other sector-based guides on fire and security issues currently in preparation focus on (among others) schools, offices and shops. IFP

For further information please contact:
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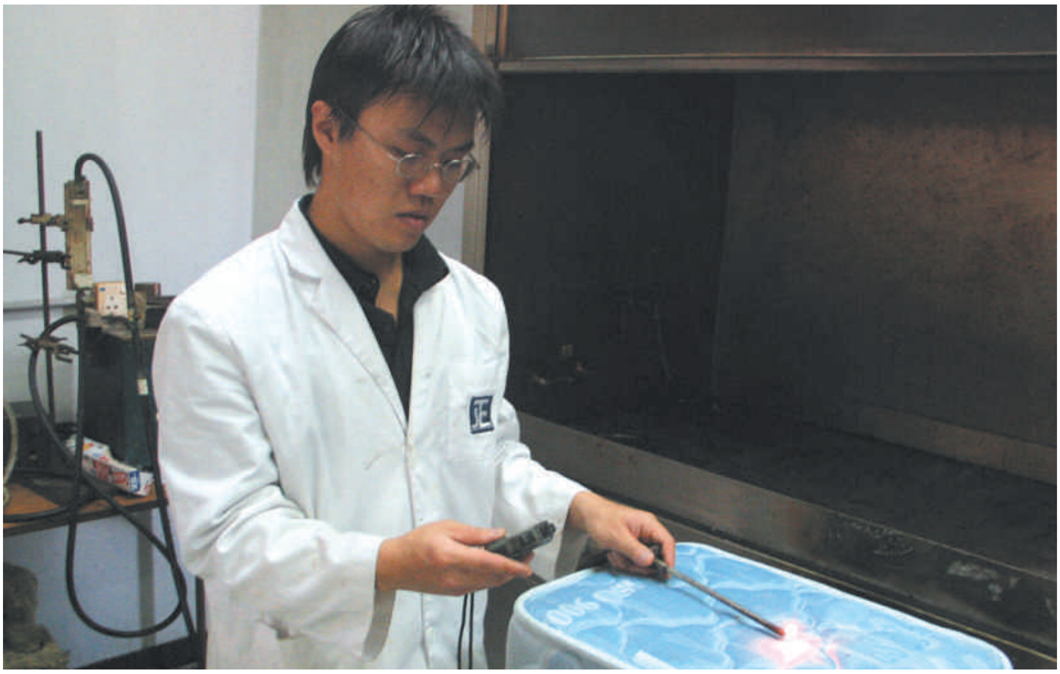


How to Minimise Risks Caused by Unsafe Products?

Taking Competitive Advantage of Product Testing

In this highly competitive business environment, most manufacturers and companies dedicate ongoing product development and testing to produce products superior to their competitor's. Product quality and especially safety performance are truly important to product superiority for manufacturers. How to ensure your products are safe and with excellent quality? Do you think of product testing enabling your products to take competitive advantage in this increasingly global marketplace?

By

Hong Kong Standards and Testing Centre (STC)

Textile and Materials Department

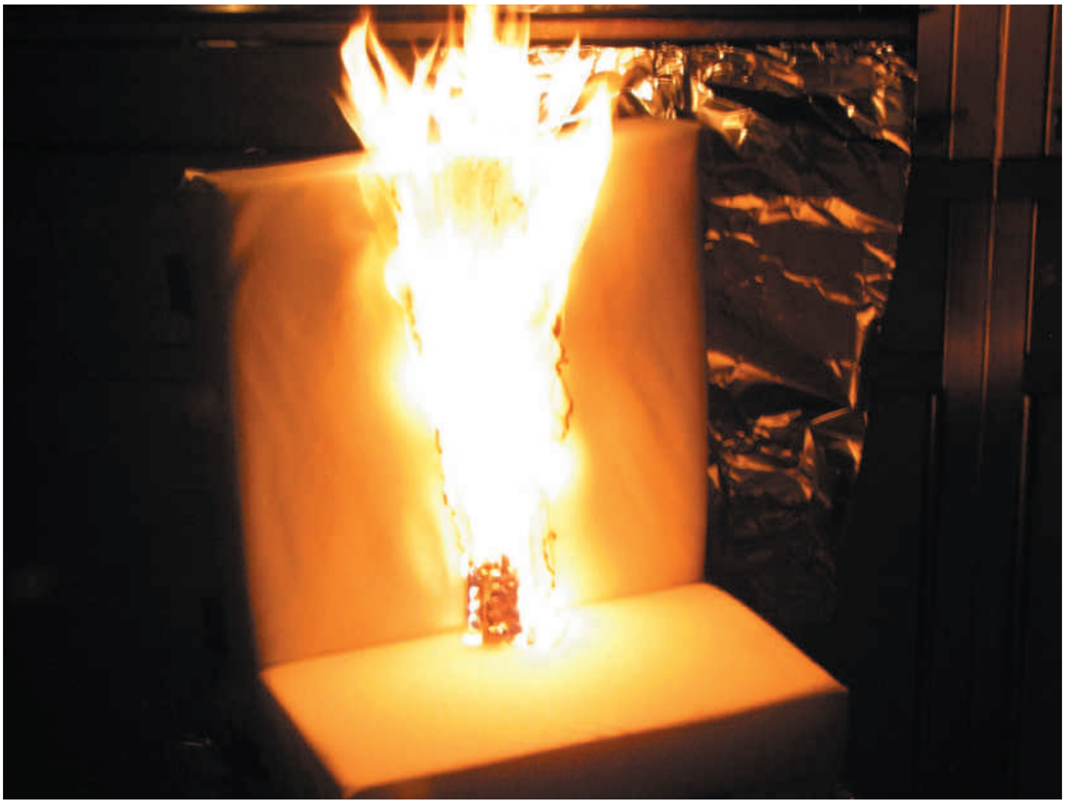
Importance of Flammability Test

Different kinds of materials react differently when subjected to heat or energy. Number of statistic reports show that the major cause of fatalities in fire can be directly attributed to the accidental ignition of different products. Hence, flammability testing is vital for your products as it can help assess and test the performance of your product materials according to proper flammability standards and requirements. Additionally, the test result also gives manufacturers the cues to improve products' flammability performance at early design stage. However, the fact is that there is no single one standard for the flammability requirements for products. In this case, different standards for flammability testing applies in different countries.

The following lists some safety requirements in certain countries:

- **2001/95/EC European General Product Safety Directive**
  It takes effect from 15 January 2004, which ensure that all consumer products placed in the market in the European Union are safe.
- **Consumer Product Safety Act (Codified at 15 U.S.C. 2051-2084)**
  Protect the public against unreasonable risks of injury associated with consumer products in U.S.A.

Pic courtesy of the Hong Kong STC



- **Consumer Goods Safety Ordinance (Cap. 456)**
  In Hong Kong, impose a duty on manufacturers, importers and suppliers of certain consumer goods to ensure that the consumer goods they supply are safe and for incidental purposes.

Examples of Some Flammability Testing Standards

In United Kingdom, there is a "Furniture and Furnishings (Fire Safety) Regulations 1988" for upholstered furniture. It states that all upholstered furniture for domestic use should be subjected to flammability test according to BS 5852 testing method mandatory. As for upholstered furniture in composite for non-domestic use, BS 7176:1995 is implicated incorporating Amendment No. 1, 2003 in accordance with different areas of risk. Mattress, divans and bed base would follow the standard of BS 7177:1996 while textile bedding items are suggested to commit BS 7175:1989. BS 4569:1983 is a standard of testing for ignitability (surface flash) of pile fabrics and assemblies having pile on the surface. Furthermore, BS 476 includes number of fire tests on building materials and structures.

Likewise, in USA, California flammability tests for upholstery are mandatory in California and often quoted or used by other States and some key furniture buyers. California Technical Bulletin #117 for furniture flammability test and California Technical Bulletin #133, Flammability test for furniture in public places where there are more than 10 seats are well known and common. By the way, California Technical Bulletin 603 is also a mandatory flammability test for mattresses, futons and bed base. Flammability test for bedding items and ticking classification would follow California Technical Bulletin 604. Furthermore, there is flammability standard for clothing textiles in USA like ASTM D1230/US CPSC 16 CFR 1610 and DOC FF3-71 US CPSC 16 CFR 1615/1616, for flammability of general clothing textiles and flammability test for children's sleepwear respectively.

For more professional items like protective clothing, BS EN 469:205 Performance requirements for protective clothing for firefighting and NFPA 1971 Standard for fire protective ensembles are most recognized standards.

Hong Kong Standards and Testing Centre (STC)

To help manufacturers minimize risks caused by unsafe products, **Hong Kong Standards and Testing Centre (STC)**, the first not-for-profit, independent, inspection and certification organization in Hong Kong, provides enterprises with a comprehensive one-stop conformity assessment service to ensure customer's products are in compliance with requisite technical and safety requirements.

Since its inception in 1963, STC has tirelessly contributed to the growth and transformation of Hong Kong industries and trade by providing the industries with highly efficient and cost-effective quality testing and certification services. Our Centre can provide tests on various products like furniture, construction materials and miscellaneous household products according to the prevailing national and international standards/ regulations or to customers' own specifications.

STC's Credentials

STC is the only CB laboratory in Hong Kong under China as the National Certification Body. It is the first laboratory accredited by China National Accreditation Board for Laboratories (CNAL), Federal Communications Commission (FCC) and Deutscher Akkreditierungs Rat (DAR), and is the

Pic courtesy of the Hong Kong STC

sole provider of complete audio and visual electromagnetic compatibility testing, HOKLAS-accredited* condom testing and Tencel/Lyocell fiber identification analysis in Hong Kong. Other than operating in accordance with ISO/ IEC17025, STC is the first ISO9001 certified laboratory in Hong Kong.

Moreover, most of the testing services offered by STC are accredited by HKAS* and other national and international accreditation bodies. Since 1999, STC has been commissioned as the exclusive testing organization accredited by SATRA Technology Centre of United Kingdom in Asia. Apart from that, specific testing items of STC's textile, footwear and materials testing have been accredited by China National Accreditation Board for Laboratories (CNAL), Hong Kong Laboratory Accreditation Scheme (HOKLAS)*, The Woolmark Company (IWS), and Marks and Spencer (M&S). Meanwhile, our test reports/certificates are recognized worldwide throughout accreditation on specific furniture, household products and transit testing by:

- Hong Kong Laboratory Accreditation Scheme (HOKLAS)
- International Safe and Transit Association (ISTA)

This signifies STC's high level of technical competence and provides our client the peace of mind.

About SATRA and HOKLAS

SATRA Technology Centre (SATRA)

SATRA Technology Centre is the world's leading research and technology organization for consumer goods industries, including footwear, clothing, leather goods and accessories, personal protective equipment, furniture, and floor coverings.

With 85 years of experience, SATRA stands head and shoulders above other commercial laboratories, particularly in its problem-solving abilities and specialist knowledge where the consumer product boundaries merge. With more than 1,500 member companies in 70 countries, SATRA prides itself on modern service delivery, coupled with traditional customer care values. SATRA's laboratories are accredited for a wide range of tests and procedures as well.

The Hong Kong Laboratory Accreditation Scheme (HOKLAS)

Hong Kong Accreditation Service (HKAS) provides accreditation for laboratories, certification bodies and inspection bodies, through the Hong Kong Laboratory Accreditation Scheme (HOKLAS), Hong Kong Certification Body Accreditation Scheme (HKCAS) and Hong Kong Inspection Body Accreditation Scheme (HKIAS) respectively.

Launched in 1985, HOKLAS is an accreditation scheme operated by Hong Kong Accreditation Service (HKAS). The scheme is open to voluntary participation from any Hong Kong laboratory that performs objective testing and calibration falling within the scope of the Scheme and meets the HOKLAS accreditation criteria.

Last but not the least, HKAS has concluded a number of mutual recognition agreements allowing the HKAS accreditations to be recognized as equivalent to accreditations granted by different accreditation schemes worldwide, including UKAS (United Kingdom), A2LA (USA), CNAL (China), SCC (Canada), JAB (Japan), etc.

Global Network

In order to keep abreast of the global development, STC has established many offices worldwide, spanning over the UK, the US, as well as major cities in mainland China. Having a worldwide certification network, STC is able to bring your products to different countries all over the world.

STC Can Help

To ensure customer's products meet the acceptable standards and requirements, STC is able to advise on the most appropriate standards and carry out tests according to customer's specifications and relevant standards and requirements. IFP

**Our laboratory is accredited by HKAS for specific tests as listed in the HOKLAS Directory of Accredited Laboratories.*

For more information, please contact:
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